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NATIOANL DAM SAFETY PROGRAM. EDEN MILL DAM (NJ00791), WHIPPANY --ETC(U)
MAY 81 R J MCDERMOTT, J E GRIBBIN DACW61-79-C-0011
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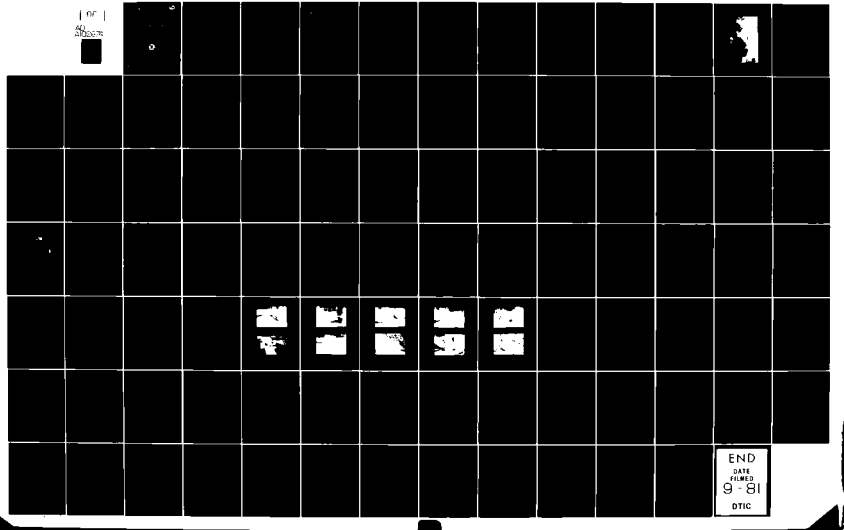

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WHIPPANY RIVER BASIN
WHIPPANY RIVER, MORRIS COUNTY
NEW JERSEY

EDEN MILL DAM
NJ 00791

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

REPT. NO: DAEN/NAP-53842/NJ00791-81/05

MAY 1981

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams	National Dam Safety Program	Seepage
Embankments	Eden Mill Dam, NJ	Concrete Walls
Visual Inspection	Whippany River Basin	Spillways
Structural Analysis	Whippany River, NJ	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE - 2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

REPLY REFER TO
NAPEN-N

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Eden Mill Dam in Morris County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Eden Mill Dam, a high hazard potential structure, is judged to be in poor overall condition. The dam's spillway is considered inadequate because a flow equivalent to 5 percent of the Spillway Design Flood - SDF - would cause the dam to be overtopped. (The SDF, in this instance, is one half of the Probable Maximum Flood). The decision to consider the spillway "inadequate" instead of "seriously inadequate" is based on the determination that dam failure resulting from overtopping would not significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, during periods of unusually heavy precipitation, around the clock surveillance should be provided.

b. Within three months from the date of approval of this report, the owner should engage a qualified professional consultant to provide the following services:

(1) With the impoundment drawn [illegible], the entire concrete dam structure should be thoroughly inspected and evaluated for distress not observed during the Phase I inspection and the structure should be repaired accordingly. As part of the evaluation, [illegible] stability analysis should be performed.

(2) The observed evidence of seepage should be monitored on a periodic basis to assess any changes in condition.

c. Within six months from the date of approval of this report the following remedial actions should be initiated:

(1) Repair spalled, eroded, and displaced concrete sections along the downstream face and apron of the dam.

(2) Repair spalled and cracked concrete on the left training wall.

(3) Repair spalled concrete training walls located on both sides of the outlet works.

(4) Repair chain link fence located along top of left training wall.

(5) Remove trees and adverse vegetation on the left embankment.

(6) Remove debris accumulated at the spillway crest and immediately downstream from the dam.

d. The owner of the dam should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam within one year from the date of approval of this report.

e. An emergency action plan and warning system should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congresswoman Fenwick of the Fifth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

NAPEN-N
Honorable Brendan T. Byrne

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions to be taken by the State to implement our recommendations.

Sincerely,

ROGER L. BALDWIN
Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

1 Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 31 December 1980 by Storch Engineers, under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Den Mill Dam, a high hazard potential structure, is judged to be in poor overall condition. The dam's spillway is considered inadequate because a flow equivalent to 5 percent of the Spillway Design Flood - SDF - would cause the dam to be overtopped. (The SDF, in this instance, is one half of the Probable Maximum Flood). The decision to consider the spillway "inadequate" instead of "seriously inadequate" is based on the determination that dam failure resulting from overtopping would not significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, during periods of unusually heavy precipitation, around the clock surveillance should be provided.

b. Within three months from the date of approval of this report, the owner should engage a qualified professional consultant to provide the following services:

(1) With the impoundment drawn down or diverted, the entire concrete dam structure should be thoroughly inspected and evaluated for distress not observed during the Phase I inspection and the structure should be repaired accordingly. As part of the evaluation, a structural stability analysis should be performed.

(2) The observed evidence of seepage should be monitored on a periodic basis to assess any changes in condition.

c. Within six months from the date of approval of this report the following remedial actions should be initiated:

(1) Repair spalled, eroded, and displaced concrete sections along the downstream face and apron of the dam.

(2) Repair spalled and cracked concrete on the left training wall.

(3) Repair spalled concrete training walls located on both sides of the outlet works.

(4) Repair chain link fence located along top of left training wall.

(5) Remove trees and adverse vegetation on the left embankment.

(6) Remove debris accumulated at the spillway crest and immediately downstream from the dam.

d. The owner of the dam should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam within one year from the date of approval of this report.

e. An emergency action plan and warning system should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

APPROVED: Roger L. Baldwin

ROGER L. BALDWIN
Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

DATE: 31 July 81

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Eden Mill Dam, NJ00791
State Located:	New Jersey
County Located:	Morris
Drainage Basin:	Whippany River
Stream:	Whippany River
Date of Inspection:	December 31, 1980

Assessment of General Conditions of Dam

Based on visual inspection, past operational performance and Phase I engineering analyses, Eden Mill Dam, a high hazard potential structure, is assessed as being in poor overall condition.

Hydraulic and hydrologic analyses indicate that the spillway is inadequate. Discharge from the spillway is not sufficient to pass the designated spillway design flood (SDF) without an overtopping of the dam. (The SDF for Eden Mill Dam is equal to one-half the probable maximum flood.) The spillway is capable of passing approximately 2 percent of the probable maximum flood or 4 percent of the SDF. Therefore, the owner should engage a professional engineer experienced in the design and construction of dams in the near future to perform more accurate hydraulic and hydrologic analyses related to spillway capacity. Based on the findings of the analyses, the need for and type of remedial measures should be determined and then implemented.

In addition, it is recommended that the following remedial measures be undertaken by the owner in the near future.

1) Repair spalled, eroded, and displaced concrete sections along the downstream face and apron of the dam.

2) Repair spalled and cracked concrete on the left training wall.

3) Repair spalled concrete training walls located on both sides of the outlet works.

4) Repair chain link fence located along top of left training wall.

5) Remove trees and adverse vegetation on the left embankment.

6) Remove debris accumulated at the spillway crest and immediately downstream from the dam.

Also, with the impoundment drawn down or diverted, the entire concrete dam structure should be thoroughly inspected and evaluated for distress not observed during the Phase I inspection and the structure should be repaired accordingly. As part of the evaluation, the need for a structural stability analysis should be assessed.

The observed evidence of seepage should be monitored on a periodic basis by a professional engineer experienced in the design and construction of dams to assess any changes in condition.

In the future, the owner of the dam should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

Richard J. McDermott, P.E.

John E. Gribbin, P.E.

OVERVIEW - EDEN MILL DAM

20 JANUARY 1981

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that the unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydraulic and hydrologic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydraulic and hydrologic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

EDEN MILL DAM, I.D. NJ00731

SECTION 1: PROJECT INFORMATION

1.1 General

a. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The Division of Water Resources of the New Jersey Department of Environmental Protection (NJDEP) in cooperation with the Philadelphia District of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the State of New Jersey. Storch Engineers has been retained by the NJDEP to inspect and report on a selected group of these dams. The NJDEP is under agreement with the Philadelphia District of the Corps of Engineers.

b. Purpose of Inspection

The visual inspection of Eden Mill Dam was made on December 31, 1980. The purpose of the inspection was to make a general assessment of the structural integrity and operational adequacy of the dam structure and its appurtenances.

1.2 Description of Project

a. Description

Eden Mill Dam is a concrete overflow dam with an ogee shape and an auxiliary spillway fitted with stoplogs at the right end of the dam. The auxiliary spillway also serves as the outlet works. A concrete apron is located along the toe of the dam and concrete training walls are located at each end of the dam.

The elevation of the spillway crest is 238.9, National Geodetic Vertical Datum (N.G.V.D.) while that of the crest of dam is 239.9. The elevation of the auxiliary spillway crest is 238.4. The downstream channel bed elevation is 228.3. The overall length of the dam is 178 feet and its height is 11.6 feet. The top width of the dam is 2 feet and the slope of the downstream face is approximately 2 horizontal to 1 vertical.

b. Location

Eden Mill Dam is located in the Township of Hanover, Morris County, New Jersey. Principal access to the dam is by Eden Mill Road which is entered from Whippany Road approximately 3000 feet from its intersection with N.J. Route 10. The dam, a run of the river structure, impounds a reach of the Whippany River.

c. Size and Hazard Classification

The dam is classified in accordance with criteria presented in "Recommended Guidelines for Safety Inspection of Dams" published by the U.S. Army Corps of Engineers. Size categories consist of Small, Intermediate and Large while hazard categories are designated as Low, Significant and High.

Size Classification: Eden Mill Dam is classified as "Small" size since its maximum storage volume is 56 acre-feet (which is less than 1000 acre-feet) and its height is 11.6 feet (which is less than 40 feet).

Hazard Classification: Visual inspection of the downstream flood plain of the dam together with breach analysis indicates that failure of the dam due to overtopping during a storm equivalent to the spillway design flood (SDF) could cause significant inundation and property damage to several industrial and residential structures and road bridges located within 1.5 miles of the dam. Loss of more than a few lives is possible. Accordingly, Eden Mill Dam is classified as "High" hazard.

d. Ownership

Eden Mill Dam is owned and operated by the Whippany Paper Board Company, 10 North Jefferson Road, Whippany, New Jersey 07981.

e. Purpose of Dam

The purpose of the dam is the impoundment of a lake used for water supply for the downstream mill owned by the Whippany Paper Board Company. Reportedly, the impoundment is not currently being used for any purpose.

f. Design and Construction History

It could not be determined when Eden Mill Dam was constructed by Whippany Paper Board Company but it was reported to have been constructed circa 1900.

g. Normal Operational Procedures

The dam and appurtenances are operated and maintained by the Whippany Paper Board Company. Repairs are made on an "as needed" basis. However, the dam is not presently in use and, reportedly, the Whippany Paper Board Company does not presently intend to make use of the dam in the future.

1.3 Pertinent Data

a. Drainage Area	31.8 square miles
b. Discharge at Damsite	
Maximum flood at damsite	2250 c.f.s. recorded by gage 2.1 mi. upstream
Outlet works at pool elevation	129 c.f.s.
Spillway capacity at top of dam	462 c.f.s.
c. Elevation (N.G.V.D.)	
Top of Dam	239.9
Maximum pool-design surcharge	245.8
Principal spillway crest	238.9
Auxiliary spillway crest	238.4
Stream bed at toe of dam	225.5
Maximum tailwater	235 (Estimated)
d. Reservoir	
Length of maximum pool	2500 feet (Estimated)
Length of recreation pool	2200 feet (Scaled)

e. Storage (Acre-feet)

Recreation pool	43 acre-feet
Design surcharge	208 acre-feet
Top of dam	56 acre-feet

f. Reservoir Surface (acres)

Top of dam	16.7 acres (Estimated)
Maximum pool - design surcharge	.8 acres (Estimated)
Recreation pool	12.9 acres

g. Dam

Type	Concrete Gravity
Length	178 feet
Height	11.6 feet
Sideslopes	
Overflow section	Ogee shape
Embankment - Upstream	3 horiz. to 1 vert.
- Downstream	2 horiz. to 1 vert.
Zoning (Emb.)	Unknown
Impervious core (Emb.)	Unknown
Cutoff (Emb.)	Unknown
Grout curtain (Emb.)	Unknown

h. Diversion and Regulating Tunnel — N.A.

i. Principal Spillway

Type	Free overflow Ogee Section
Length of weir	136 feet
Crest elevation	238.9
Approach channel	N.A.
Discharge channel	Natural Stream bed

j. Auxiliary Spillway

Type	Concrete Stoplogs
Length of weir	
Primary	4 feet
Secondary	8 feet
Crest elevation	
Primary	238.4
Secondary	239.2
Approach channel	N.A.
Discharge channel	Natural Stream bed

k. Regulating Outlet

Concrete stoplogs, 4 feet long, in auxiliary spillway structure.

SECTION 2: ENGINEERING DATA

2.1 Design

No plans or calculations pertaining to the original design of the dam could be obtained. Drawings prepared in 1938 in connection with a WPA project showing the Whippany River profile including the dam are on file with the Hanover Township Engineering Department.

2.2 Construction

No data or reports pertaining to the construction of the dam are available.

2.3 Operation

No data or reports pertaining to the operations of the dam are available.

2.4 Evaluation

a. Availability

Available engineering data is limited to that which is on file at the Hanover Township Engineering Department.

b. Adequacy

Available engineering data pertaining to Eden Mill Dam is not adequate to be of significant assistance to the performance of a Phase I evaluation. A list of absent information is included in paragraph 7.1.b.

c. Validity

The validity of engineering data cannot be assessed due to the absence of data.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

The inspection of Eden Mill Dam was performed on December 31, 1980 by staff members of Storch Engineers. A copy of the visual inspection check list is contained in Appendix 1. The following procedures were employed for the inspection:

1) The embankment of the dam, appurtenant structures and adjacent areas were examined.
2) The embankment and accessible appurtenant structures were measured and key elevations determined by surveyor's level.
3) The embankment, appurtenant structures and adjacent areas were photographed.
4) The downstream flood plain was toured to evaluate downstream development and restricting structures.

b. Dam

The apron running along the toe was severely spalled throughout its entire length and was almost entirely broken away for a 75-foot long section near the center of the dam.

The downstream surface of the dam was in deteriorated condition. The concrete was eroded and spalled and there were sections near the center that had broken away. The condition of the concrete at the crest, however, appeared to be satisfactory. A horizontal construction joint was observed about 3 feet below the crest. The joint divided the areas of poor concrete condition below and satisfactory condition above. The left training wall appeared to be sound. However, it was spalled

and cracked. A portion of the wall at its base was broken away and evidence of seepage emerging from the hole was observed. Orange colored deposits were observed in the vicinity of the hole.

A chain link fence at the top of the left training wall was in severely deteriorated condition, and had fallen onto the apron of the dam.

At one location on the downstream side of the dam approximately 30 feet from the outlet works there was a large hole where concrete had broken away. It measured approximately 3 feet in diameter and revealed the interior of the dam. It indicated that the downstream face was a slab of concrete approximately 4 to 6 inches thick overlying rock fill.

The surface of the training walls on each side of the outlet works were severely deteriorated by spalling. At the interface between the wall and the downstream side of the dam the spalling was about 6 inches deep revealing an interior resembling cyclopean masonry. The outlet works was discharging water at the time of the inspection and there was also a trickle of water coming over the main spillway section.

The earth embankment adjacent to the left end of the spillway was stabilized on its crest by boulders (12 inches to 30 inches in diameter). The boulders appeared to be hand-placed although they were obscured by vegetation. The upstream and downstream sides were overgrown with trees and briars.

The earth abutment at the right end of the dam was stabilized with boulders which appeared inadequate as slope protection.

c. Appurtenant Structures

The outlet works was composed of a steel I-beam framework which divides the opening into three sections, each fitted with concrete stoplogs. The stoplogs appeared to be intact and essentially sound. Also the steel framework appeared to be sound. A pile of rocks or boulders was observed on the apron of the dam at the downstream end of the training walls for the outlet works. The boulders appeared to be intended as an energy dissipator.

d. Reservoir Area

The impoundment of the dam, the Whippany River, is 2200 feet long with a width varying from 150 feet to 300 feet.

Along the left side of the reservoir was a grassy shore with a bank about 4 feet to 5 feet high and just beyond the bank was a paved road. The paved road extended around the upstream end of the reservoir and crossed the reservoir by a bridge. The left side of the reservoir consisted of a grassy bank with a slope of approximately 1 horizontal to 1 vertical and approximately 10 feet high. Beyond the bank, the terrain was flat and contained an industrial complex. The left portion of the impoundment extends downstream from the dam forming the upstream end of an abandoned raceway to the mill downstream.

e. Downstream Channel

The downstream channel in the vicinity of the dam consisted of a wide stream with banks approximately 12 feet high on each side. The bed was lined with boulders and contained a few islands covered with bushes and trees. On the right bank there was evidence of a significant amount of erosion which had exposed the roots of trees. A heavily travelled road was observed above the bank.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

The level of water in the impoundment of the subject dam is regulated by discharge over the concrete ogee shaped spillway and the auxiliary spillway located at the right end of the dam. The dam is used to draw off water for the purpose of supplying the mill downstream. A raceway is located to the left of the dam. However, the dam and raceway reportedly are no longer in use.

4.2 Maintenance of the Dam

Reportedly, maintenance is performed on an "as needed" basis.

4.3 Maintenance of Operating Facilities

Reportedly, the outlet works is maintained on an "as needed" basis.

4.4 Description of Warning System

Reportedly, no warning system is currently in use for the dam.

4.5 Evaluation of Operational Adequacy

The operation of the dam has not been successful to the extent that the dam reportedly has been overtopped in the past.

Maintenance is inadequate and maintenance documentation is poor. Areas of maintenance that have not been adequately performed are:

1) Extensive deterioration of the concrete portions of the dam has not been corrected.
2) Debris at dam site has not been removed.

3) Chain link fence located along top of left training wall has not been repaired.

4) Trees and other adverse vegetation on left embankment and right abutment have not been removed.

5) Erosion on the right bank of the downstream channel has not been corrected.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

The quantity of storm water runoff that the spillway should be able to handle is based on the size and hazard classification of the dam. This runoff quantity, called the spillway design flood (SDF) is described in terms of return frequency or probably maximum flood (PMF) depending on the extent of the dam's size and potential hazard. According to the "Recommended Guidelines for Safety Inspecton of Dams" published by the U.S. Army Corps of Engineers, the SDF for Eden Mill Dam falls in a range of 1/2 PMF to PMF. In this case, the low end of the range, 1/2 PMF, is chosen since the factors used to select size and hazard classification are on the low side of their respective ranges.

The SDF peak computed for Eden Mill Dam is 14,649 c.f.s. This value is derived from the 1/2 PMF flood hydrograph computed by the use of the HEC-1-DAM Flood Hydrograph Computer Program using the Soil Conservation Service triangular unit hydrograph with curvilinear transformation. Hydrologic computations and computer output are contained in Appendix 4.

The spillway discharge rates were computed by the use of weir formulae appropriate for the spillway configurations. The combined principal and auxiliary spillway discharge with lake level equal to the top of the dam was computed to be 462 c.f.s. The SDF was routed through the dam by use of the HEC-1-DAM computer program using the modified Puls method. In routing the SDF, it was found that the dam crest would be overtopped by a depth of 5.9 feet.

A dam breach analysis was then performed using a trapezoidal breach section with bottom length of 71 feet and sideslopes of 1 horizontal to 1 vertical. The breach peak outflow was computed to be 14,627 c.f.s. Dam breach computations are contained in Appendix 4. The analysis indicated that dam failure due to overtopping would not significantly increase the potential for loss of life over that which would exist without failure. Accordingly, the subject spillway is assessed as being inadequate in accordance with criteria developed by the U.S. Army Corps of Engineers.

b. Experience Data

During past periods of heavy rainfall, flooding has been reported approximately 7500 feet downstream where the Whippany River crosses under Whippany Road. Estimates of extent of inundation and property damage could not be obtained.

c. Visual Observation

No evidence of overtopping of the earth embankment at the left end of the dam was observed. Severe erosion of the downstream channel bank, indicating high flows in the past, was observed.

d. Overtopping Potential

As indicated in paragraph 5.1.a. a storm of magnitude equal to the SDF would cause overtopping of the dam by a depth of 5.9 feet over the crest of the dam. The spillway is capable of passing approximately 2 percent of the PMF or 4 percent of the SDF with lake level equal to the top of dam.

e. Drawdown Data

Drawdown of the impoundment is accomplished by removing concrete stoplogs from the center section of the auxiliary spillway. Total drawdown time is estimated to be 10.6 hours (See Appendix 4).

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The dam exhibited, at the time of inspection, significant deterioration. Although the observed deterioration does not indicate immediate instability, the dam could become unstable if repairs are not implemented.

b. Generalized Soils Description

The generalized soils description of the dam site consists of recent alluvium composed of stratified materials deposited by streams, overlying glacial ground moraine deposited during the Wisconsin glaciation. The glacial moraine is composed of silts and silty sands and overlies shale and sandstone.

c. Design and Construction Data

Analyses of structural stability and construction data for the dam are not available.

d. Operating Records

No operating records are available for the dam.

e. Post-Construction Changes

Reportedly, there have been no post-construction changes since the dam was constructed.

f. Seismic Stability

Eden Mill Dam is located in Seismic Zone 1 as defined in "Recommended Guidelines for Safety Inspection of Dams" which is a zone of very low seismic activity. Experience indicates that dams in Seismic Zone 1 will have adequate stability under seismic loading conditions if they have adequate stability under static loading conditions. Eden Mill Dam which exhibited extensive deterioration could be unstable under seismic loading conditions.

SECTION 7: ASSESSMENT AND RECOMMENDATIONS

7.1 Dam Assessment

a. Safety

Based on hydraulic and hydrologic analyses outlined in Section 5 and Appendix 4, the spillway of the subject dam is assessed as being inadequate. The spillway is not able to pass the SDF without an overtopping of the dam.

The dam exhibited, at the time of inspection, significant deterioration. Although the observed deterioration does not indicate immediate instability, the dam could become unstable if repairs are not implemented.

b. Adequacy of Information

Information sources for this report include 1) field inspections, 2) USGS quadrangle, 3) profile of portion of Whippany River on file with the Hanover Township Engineering Department, 4) consultation with personnel of the Hanover Township Engineering Department, 5) consultation with personnel of the Whippany Paper Board Company. The information obtained is sufficient to allow a Phase I assessment as outlined in "Recommended Guidelines for Safety Inspection of Dams."

Some of the absent data are as follows:

1. Construction and as-built drawings
2. Description of fill material for embankment.
3. Design computations and reports.
4. Maintenance documentation.
5. Soils report for the site.

c. Necessity for Additional Data/Evaluation

Although some data pertaining to Eden Mill Dam are not available, additional data are not considered imperative for this Phase I evaluation.

7.2 Recommendations

a. Remedial Measures

Based on hydraulic and hydrologic analyses outlined in paragraph 5.1.a, the spillway is considered to be inadequate. It is therefore recommended that a professional engineer experienced in the design and construction of dams be engaged in the near future to perform more accurate hydraulic and hydrologic analyses related to spillway capacity. Based on the findings of these analyses, the need for and type of remedial measures should be determined and then implemented.

In addition, it is recommended that the following remedial measures be undertaken by the owner in the near future.

1) Repair spalled, eroded, and displaced concrete sections along the downstream face and apron of the dam.

2) Repair spalled and cracked concrete on the left training wall.

3) Repair spalled concrete training walls located on both sides of the outlet works.

4) Repair chain link fence located along top of left training wall.

5) Remove trees and adverse vegetation on the left embankment.

6) Remove debris accumulated at the spillway crest and immediately downstream from the dam.

Also, with the impoundment drawn down or diverted, the entire concrete dam structure should be thoroughly inspected and evaluated for distress not observed during the Phase I inspection and the structure should be repaired accordingly. As part of the evaluation, the need for a structrual stability analysis should be assessed.

b. Maintenance

In the future, the owner of the dam should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

c. Additional Studies

The observed evidence of seepage should be monitored on a periodic basis by a professional engineer experienced in the design and construction dams to assess any changes in condition.

PLATES

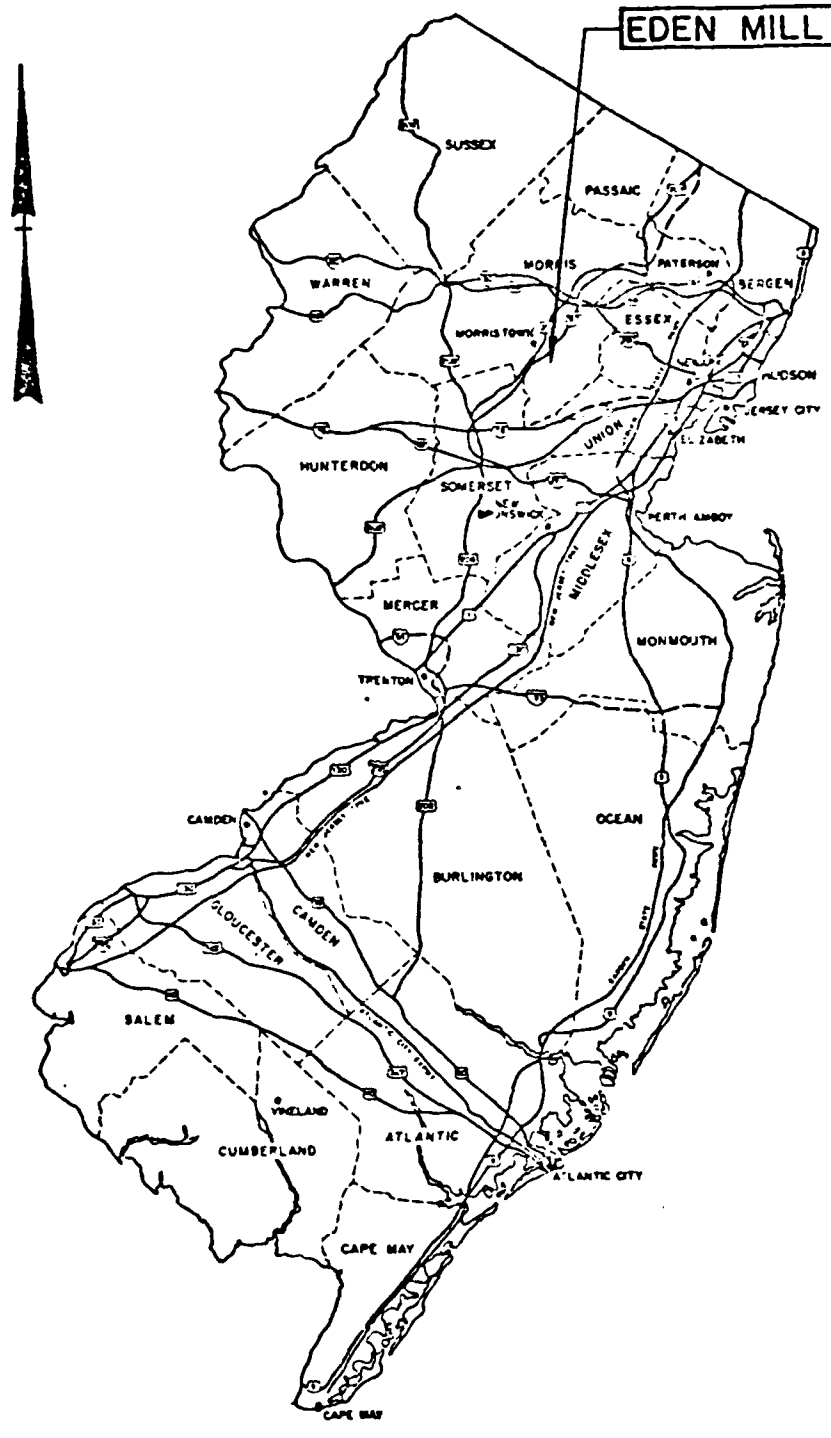
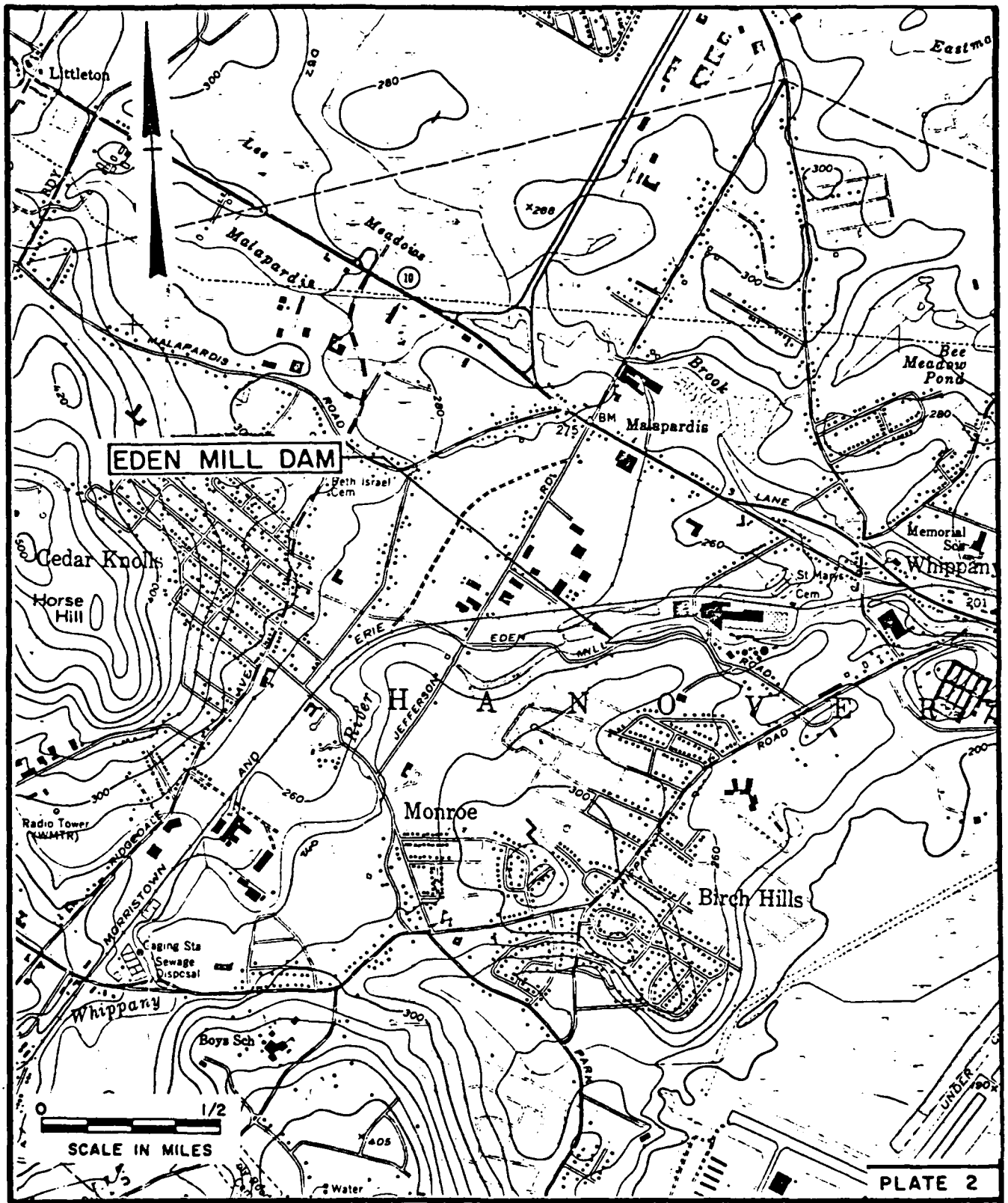


PLATE 1

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS KEY MAP EDEN MILL DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	SCALE: NONE DATE: FEB. 1981



STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

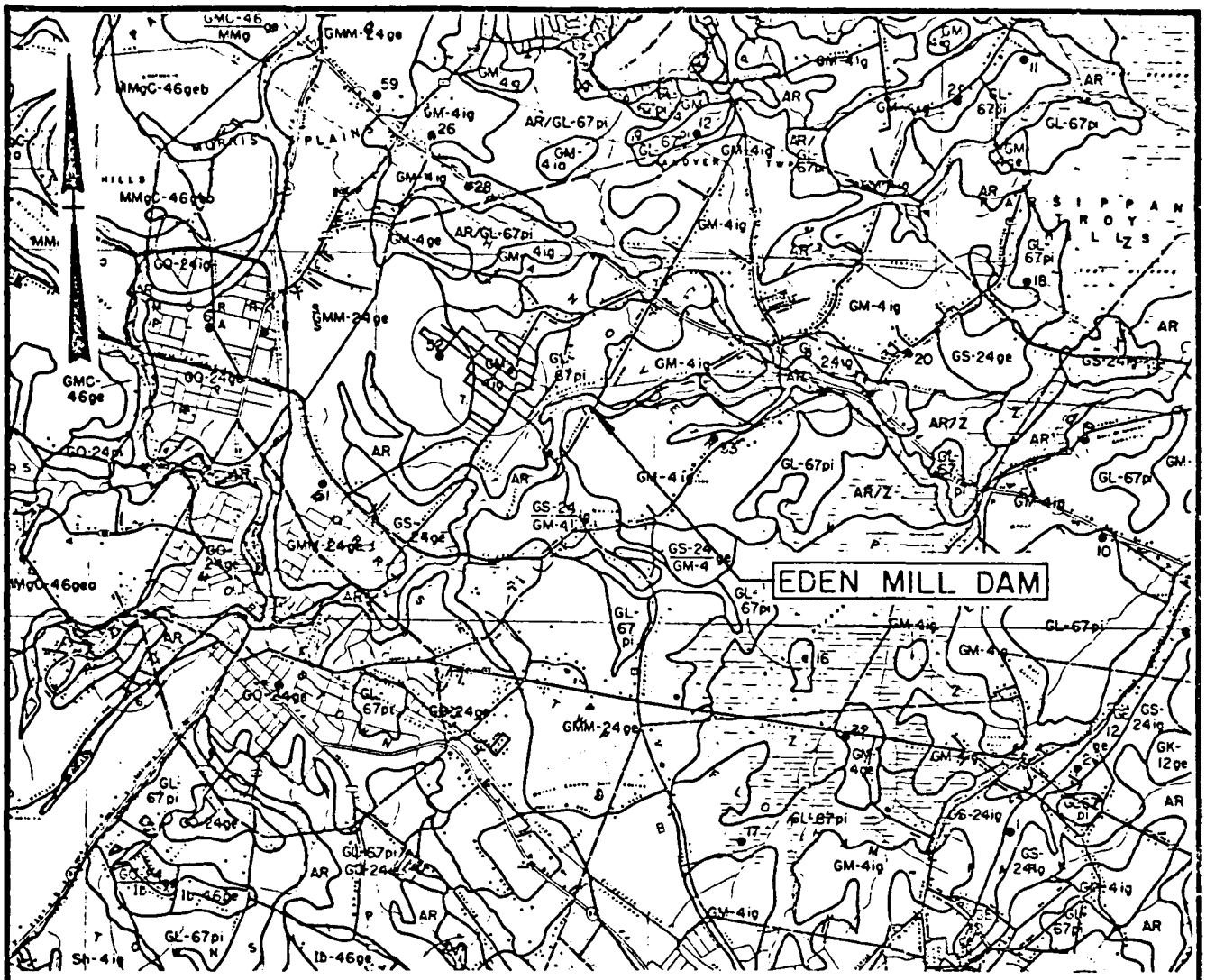
INSPECTION AND EVALUATION OF DAMS

VICINITY MAP

EDEN MILL DAM

SCALE: AS SHOWN

DATE: FEB. 1981



Legend

AR	Recent alluvium, composed of stratified materials deposited by streams.
GM-4	Glacial ground moraine; composed of unstratified material deposited during the Wisconsin glaciation.

Note: Information taken from: Rutgers University, Engineering Soil Survey of New Jersey, Report No. 9, Morris County, November 1953 and Geologic Map of New Jersey prepared by J. V. Lewis and H. Kummel 1910-1912, revised by H. B. Kummel 1931 and M. Johnson 1950.

PLATE 3

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY.

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY.

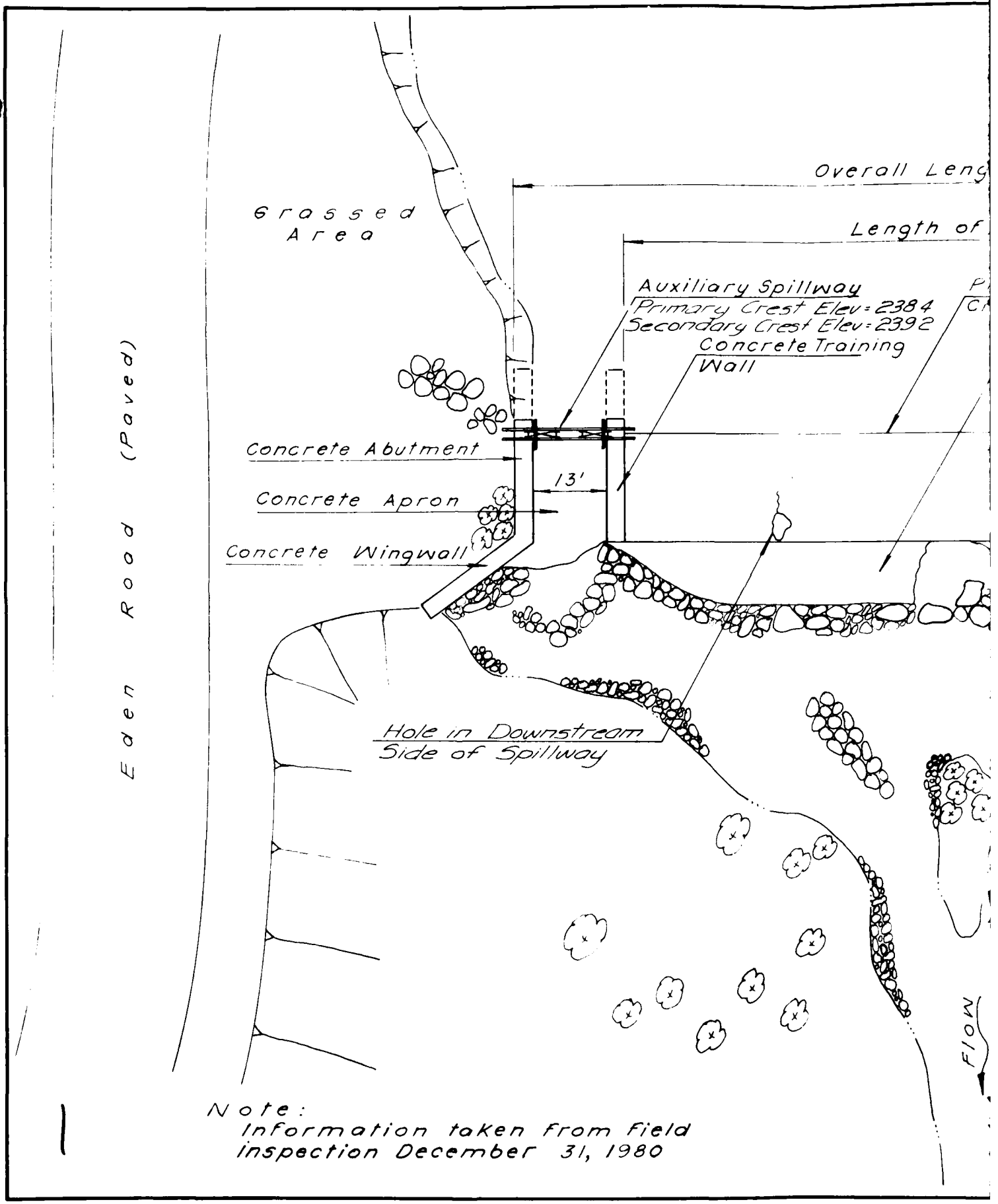
INSPECTION AND EVALUATION OF DAMS

SOIL MAP

EDEN MILL DAM

SCALE: NONE

DATE: FEB. 1981



Note:
Information taken from Field Inspection December 31, 1980

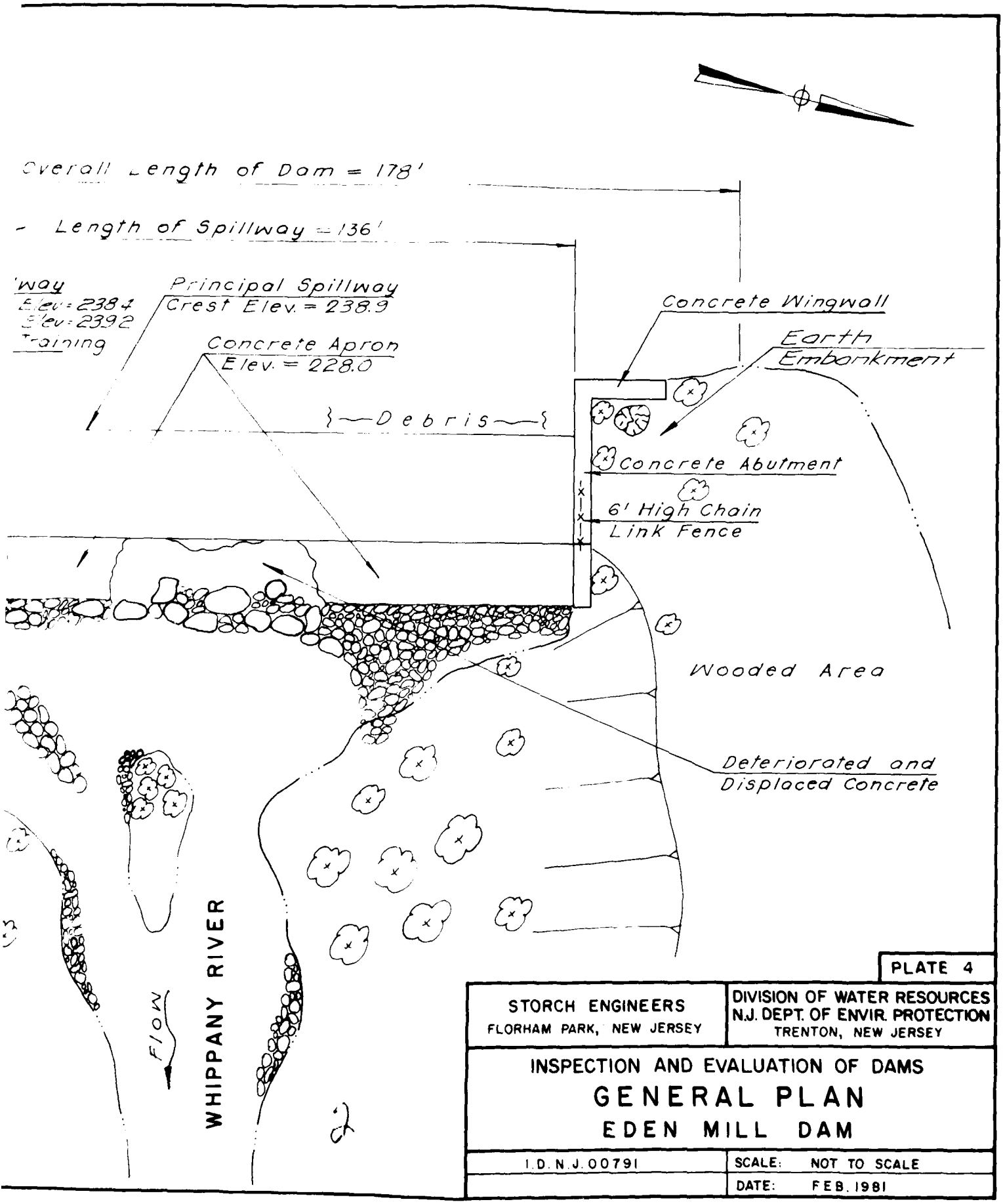


PLATE 4

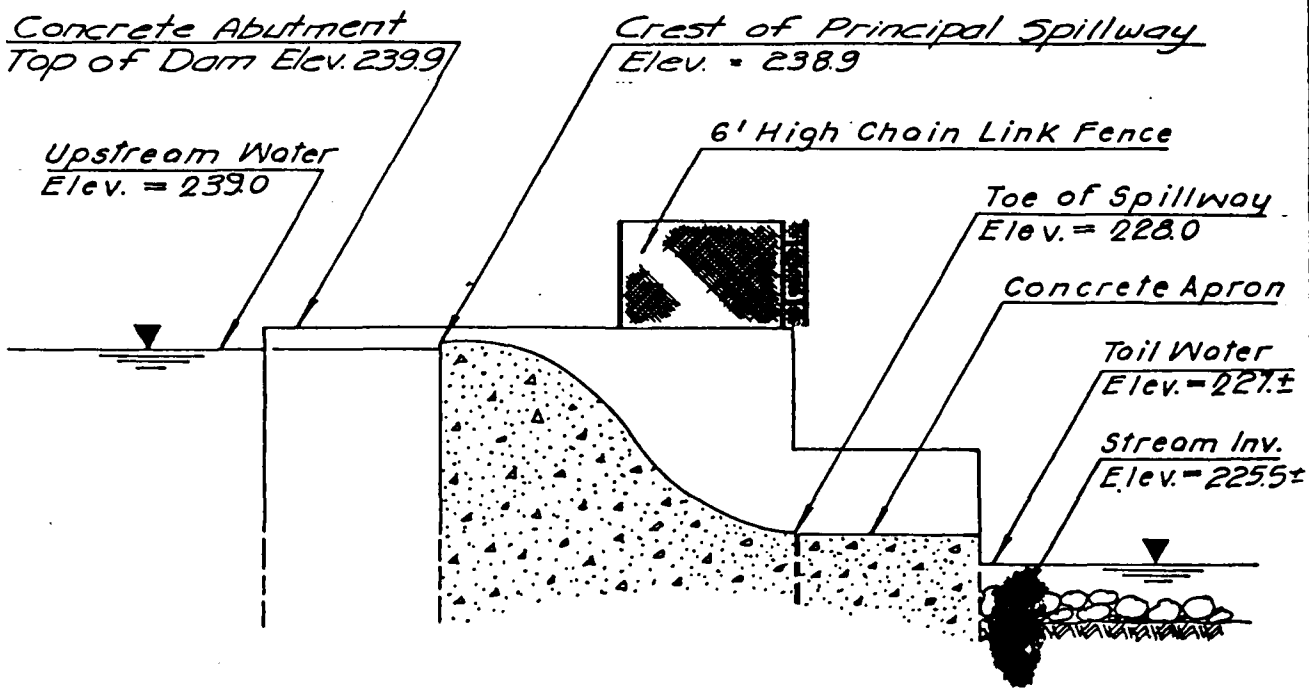
STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

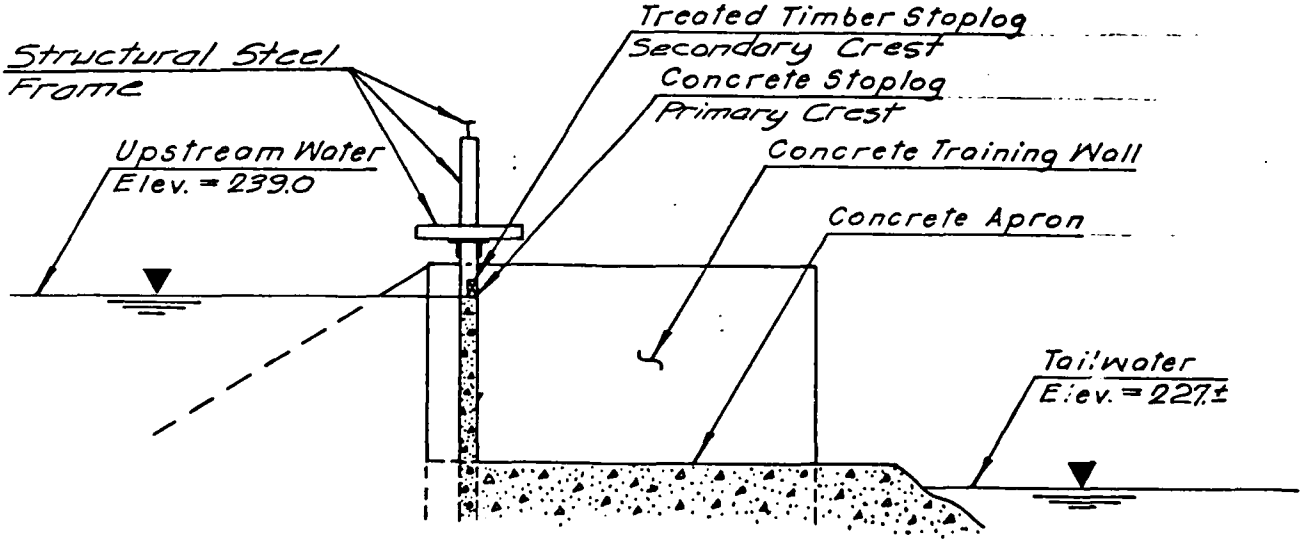
GENERAL PLAN

EDEN MILL DAM

I.D. N.J. 00791	SCALE: NOT TO SCALE
	DATE: FEB. 1981



PRINCIPAL SPILLWAY SECTION

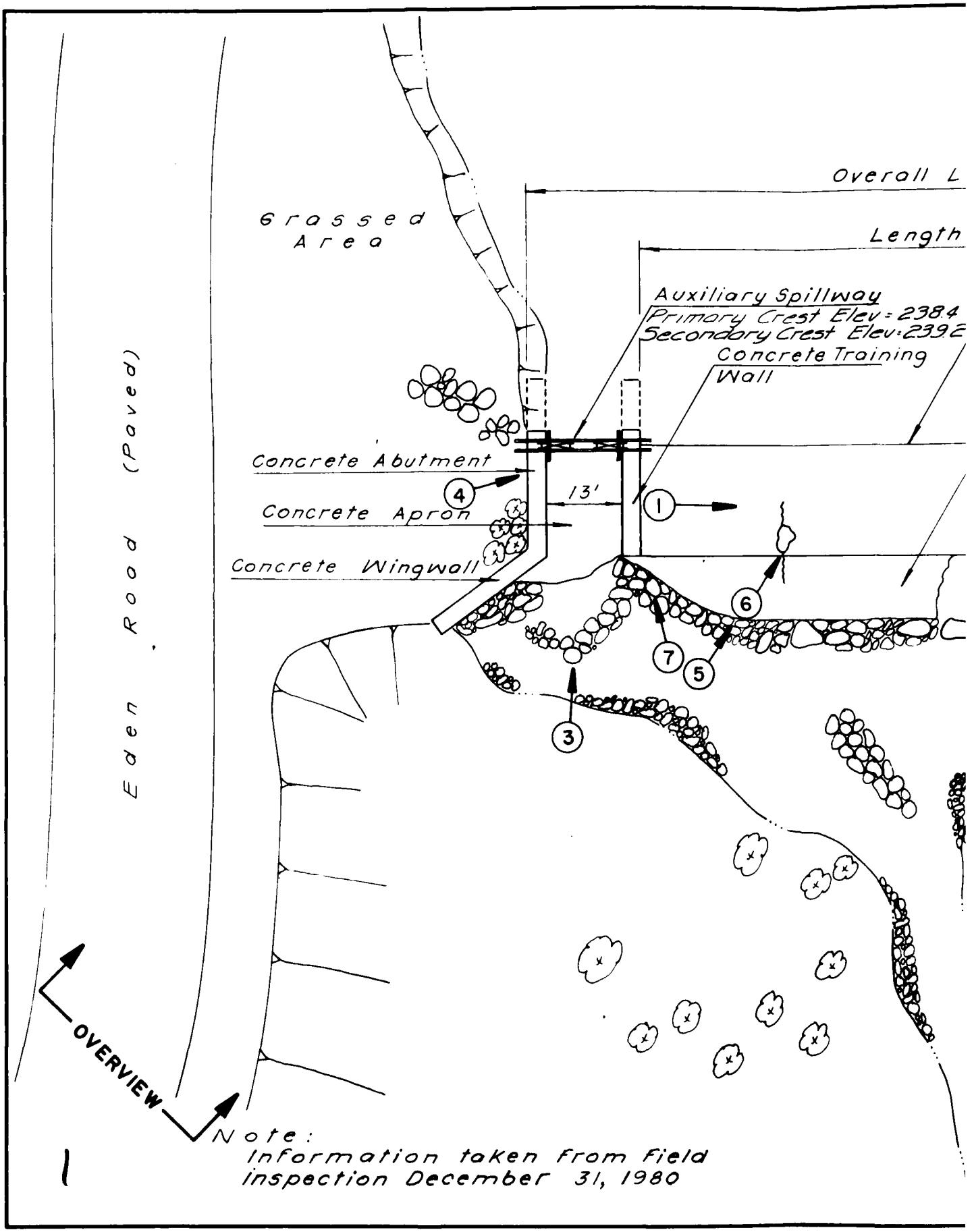


OUTLET WORKS SECTION

Note:
Information token from field inspection December 31, 1980

PLATE 5

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS SECTIONS EDEN MILL DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D. N.J. 00791 / SCALE: NONE DATE: FEB. 1981


Overall L
Grassed Area
Length
Auxiliary Spillway
Primary Crest Elev = 2384
Secondary Crest Elev = 2392
Concrete Training Wall
Concrete Abutment
Concrete Apron
Concrete Wingwall
13'
Eden Road (Paved)
OVERVIEW
Note:
Information taken From Field inspection December 31, 1980

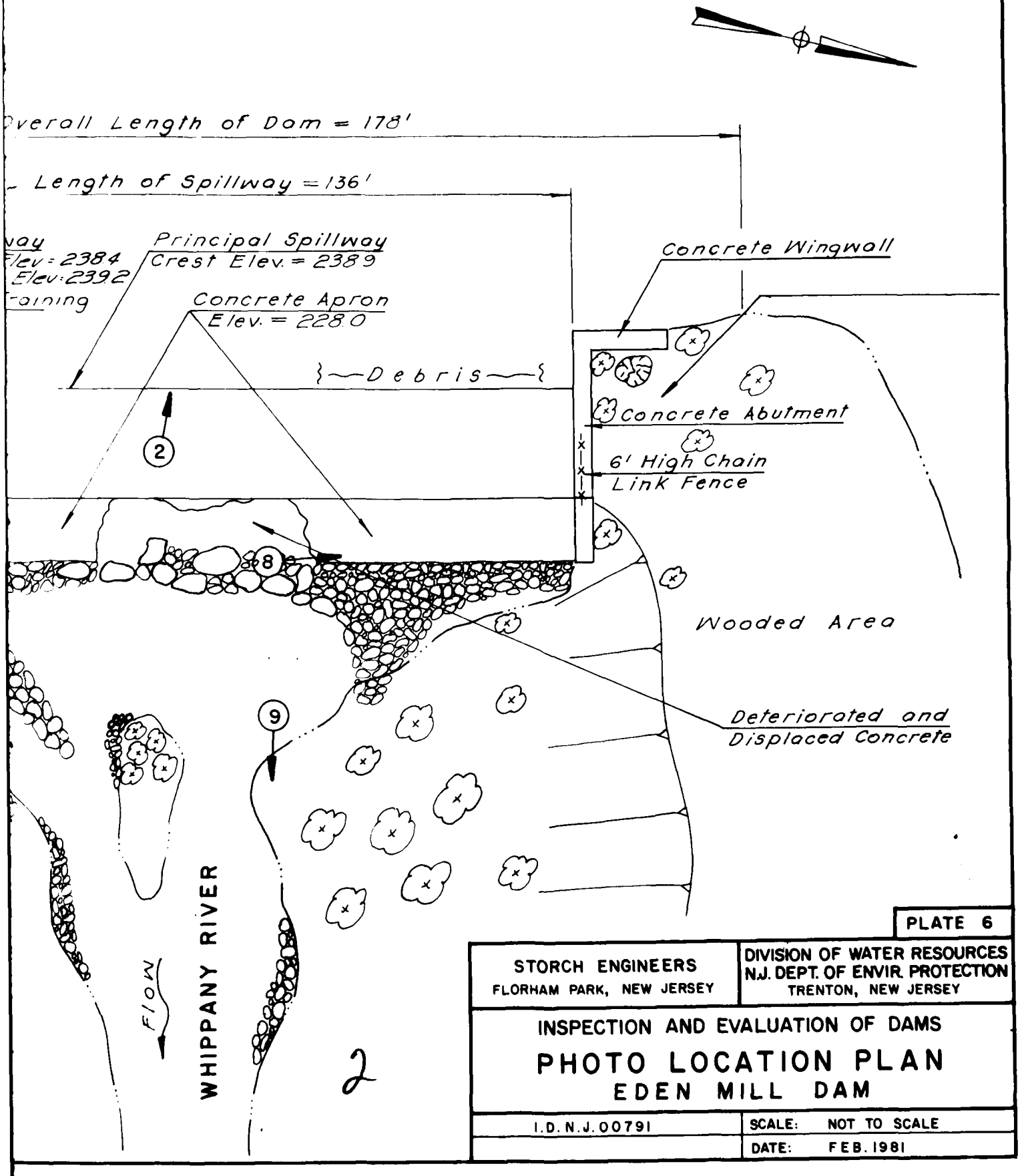


PLATE 6

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

PHOTO LOCATION PLAN
EDEN MILL DAM

I.D. N.J. 00791	SCALE: NOT TO SCALE
	DATE: FEB. 1981

APPENDIX 1

Check List - Visual Inspection

Check List - Engineering Data

Check List

Visual Inspection

Phase I

Name of Dam Eden Mill Dam County Morris State N.J. Coordinators NJDEP

Date(s) Inspection 12/31/80 Weather P. Sunny Temperature 25°F

Pool Elevation at time of Inspection 239.0 M.S.L. Tailwater at Time of Inspection 227.0 M.S.L.

Inspection Personnel:

John Gribbin Richard McDermott

Daniel Buckelew

Mark Brady

John Gribbin Recorder

Owner Not Present

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
GENERAL	Concrete surfaces generally in deteriorated condition. Training walls spalled and cracked. Spalls at some locations approx. 6" deep revealing cyclopean type material beneath the concrete surface. Interior rocks 4" to 16" in size.	Concrete portion of dam should be thoroughly inspected with impoundment drawn down.
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Appeared generally sound. Soil adjacent to right abutment was not protected against erosion.	Soil adjacent to right abutment should be properly stabilized.
DRAINS	None observed	
WATER PASSAGES	None observed	
APRON	Severely deteriorated with cracks and spalls noted. Section approx. 75' long near center of spillway section broken away.	
VERTICAL AND HORIZONTAL ALIGNMENT	Vertical: level Horizontal: straight	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Most surfaces of the training walls, apron and downstream side of spillway section exhibited extensive cracking.	All concrete surfaces exhibiting cracking should be repaired.
STRUCTURAL CRACKING	Hole observed in downstream side of spillway section about 30' from outlet works. Large vertical crack above and below hole. Within hole, rock-fill interior of dam was observed. Exterior concrete slab appeared 4" to 6" thick.	Areas of displaced concrete should be repaired.
CONSTRUCTION JOINTS	Horizontal construction joint observed in spillway section about 3' below crest extending for entire length. Condition of concrete above joint satisfactory. Concrete below joint eroded, spalled, cracked and broken.	Concrete below joint should be repaired.
MONOLITH JOINTS	N.A.	
LEAKAGE	None observed	
SEEPAGE	Orange colored stains in stream bed about 10' downstream from dam could be due to seepage. Standing water with orange colored deposits observed at broken area at base of left training wall.	Seepage should be monitored on a periodic basis.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
GENERAL	Overgrown with briars and trees	Embankment at left end of spillway section about 20' long. Trees and adverse vegetation should be removed.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Appeared to be sound.	
ANY NOTICEABLE SEEPAGE	None observed.	
STAFF GAGE AND RECORDER	None observed.	
DRAINS	None observed.	

EMBANKMENT

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Vertical: generally level Horizontal: generally straight, slightly irregular.	
RIPRAP	Crest stabilized by boulders about 12" to 30" in size. Stabilization appeared adequate although boulders were obscured by vegetation.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SURFACES IN OUTLET CONDUIT	Concrete training walls and apron severely deteriorated by spalling and cracking.	Deteriorated concrete should be repaired.
INTAKE STRUCTURE	N.A.	
OUTLET STRUCTURE	N.A.	
OUTLET CHANNEL	Outlet works discharge directly into downstream channel.	
GATE AND GATE HOUSING	Concrete and timber stoplogs appeared to be in satisfactory condition. Structural steel frame in which stoplogs were fitted was rusted but appeared sound.	

SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
WEIR	Spillway section comprises concrete gravity portion of dam. See "Concrete/Masonry Dams."	
APPROACH CHANNEL	N.A.	
DISCHARGE CHANNEL	Spillway discharges directly into downstream channel (Whippany River)	
APRON	See "Concrete/Masonry Dams."	

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None observed.	
OBSERVATION WELLS	None observed.	
WEIRS	None observed.	
PIEZOMETERS	None observed.	
OTHER	River gaging station located on Whippany River about 2.1 miles upstream from dam.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Bank 4' to 5' high along right side. Shore slope along left side about 1 horiz. to 1 vert. and about 10' high.	
SEDIMENTATION	Unknown.	
STRUCTURES ALONG BANKS	Road bridge at upstream end. Industrial building and yard along left shore. Left portion of reservoir extends downstream from dam forming upstream end of abandoned raceway to downstream mill.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTION, DEBRIS, ETC.)	Natural river with rocky bed and high grassy banks. Right bank was significantly eroded with tree roots exposed. Debris observed along spillway crest and in area immediately downstream from dam. A few islands containing bushes and trees were observed in the river within 100' of the dam.	Debris should be removed. River bank should be properly stabilized.
SLOPES	Banks are steep and approx. 10' to 12' high.	
STRUCTURES ALONG BANKS	Paved road is located along right bank for about 1500' downstream. Mill complex located about 2000' from dam. Road bridges located 4000' and 5700' from the dam. Several dwellings, commercial buildings and industrial buildings located along river from 4000' to 8000' from dam. Heights above river invert range from 5' to 10'.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM			REMARKS
DAM	-	PLAN	Not available
		SECTIONS	
SPILLWAY	-	PLAN	Not available
		SECTIONS	Undetailed section of spillway shown on profile of Whippany River prepared in 1938 for W.P.A. project available at Hanover Township Engineering Department, P.O. Box 250, Whippany, N.J. 07981.
		DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS			Not available
OUTLETS	-	PLAN	Not available
		DETAILS	
		CONSTRAINTS	
		DISCHARGE RATINGS	
HYDRAULIC/HYDROLOGIC DATA			Gaging data available from NJDEP for USGS gage located approx. 2.1 miles upstream from dam. NJDEP, Division of Water Resources, P.O. Box CN-029, Trenton, New Jersey 08625
RAINFALL/RESERVOIR RECORDS			Not available
CONSTRUCTION HISTORY			Not available
LOCATION MAP			Not available

ITEM	REMARKS
DESIGN REPORTS	Not available
GEOLOGY REPORTS	Not available
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM INSTABILITY SEEPAGE STUDIES	Not available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Not available
POST-CONSTRUCTION SURVEYS OF DAM	Not available
BORROW SOURCES	Not available

ITEM	REMARKS
MONITORING SYSTEMS	U.S.G.S. gaging station located 2.1 miles upstream from dam.
MODIFICATIONS	Not available
HIGH POOL RECORDS	Not available
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Not available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Not available
MAINTENANCE OPERATION RECORDS	Not available

APPENDIX 2

Photographs

PHOTO 1

CREST AND DOWNSTREAM FACE OF SPILLWAY

PHOTO 2

DETAIL OF DETERIORATION ON DOWNSTREAM FACE OF SPILLWAY

EDEN MILL DAM
31 DECEMBER 1980

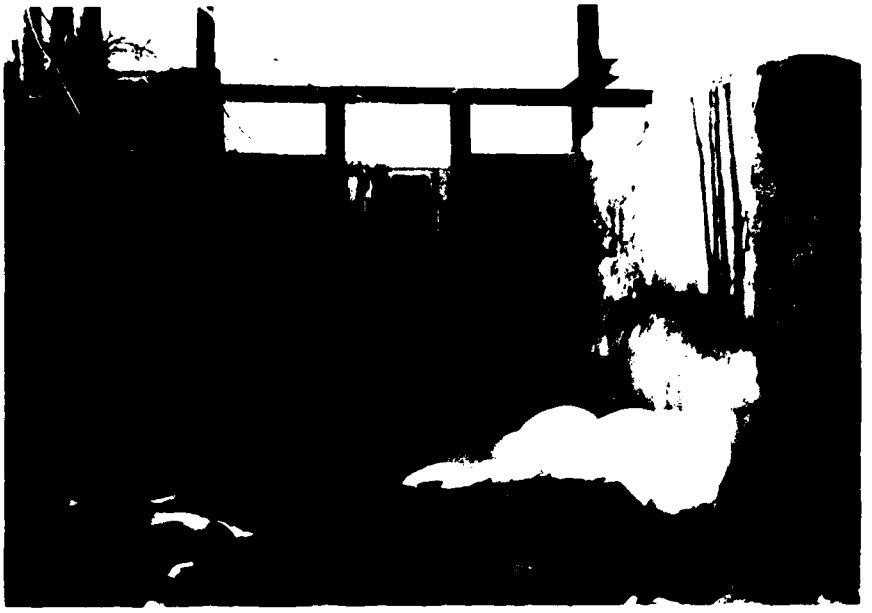


PHOTO 3

DOWNSTREAM VIEW OF OUTLET WORKS

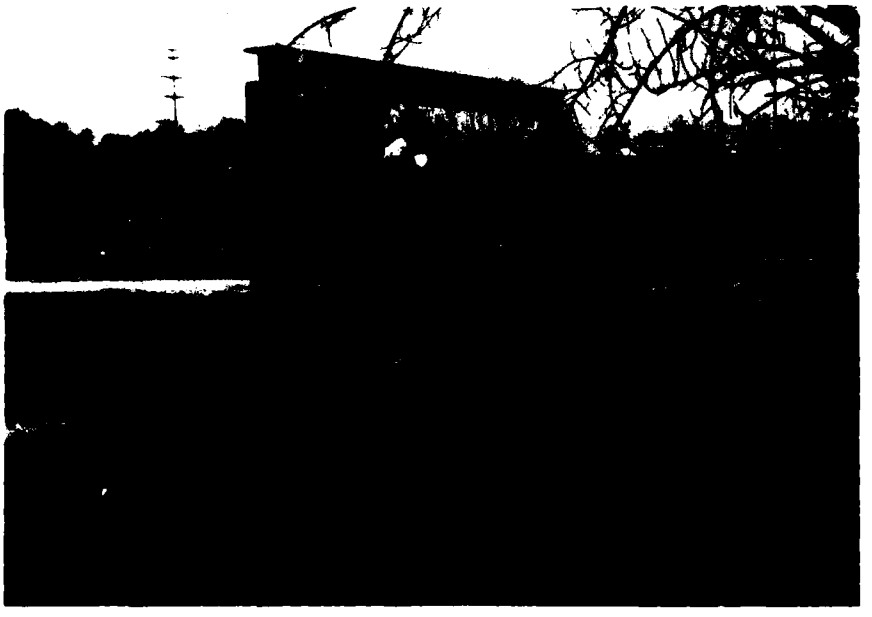


PHOTO 4

STRUCTURAL STEEL FRAME OVER OUTLET WORKS

EDEN MILL DAM

31 DECEMBER 1980

PHOTO 5

HOLE IN DOWNSTREAM FACE OF SPILLWAY

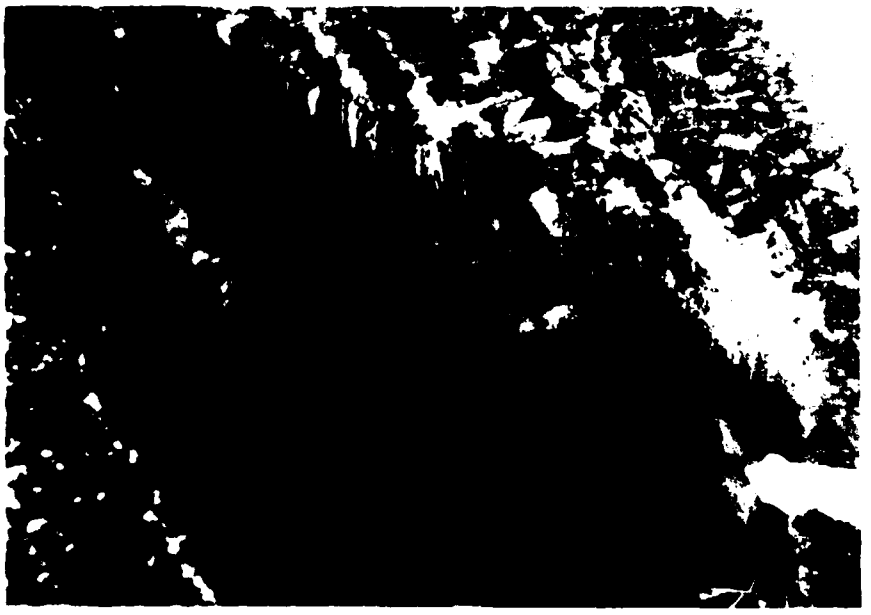


PHOTO 6

DETAIL OF HOLE SHOWING ROCK INTERIOR OF SPILLWAY STRUCTURE

EDEN MILL DAM

31 DECEMBER 1980

PHOTO 7

DETERIORATED TRAINING WALL BETWEEN SPILLWAY AND OUTLET WORKS

PHOTO 8

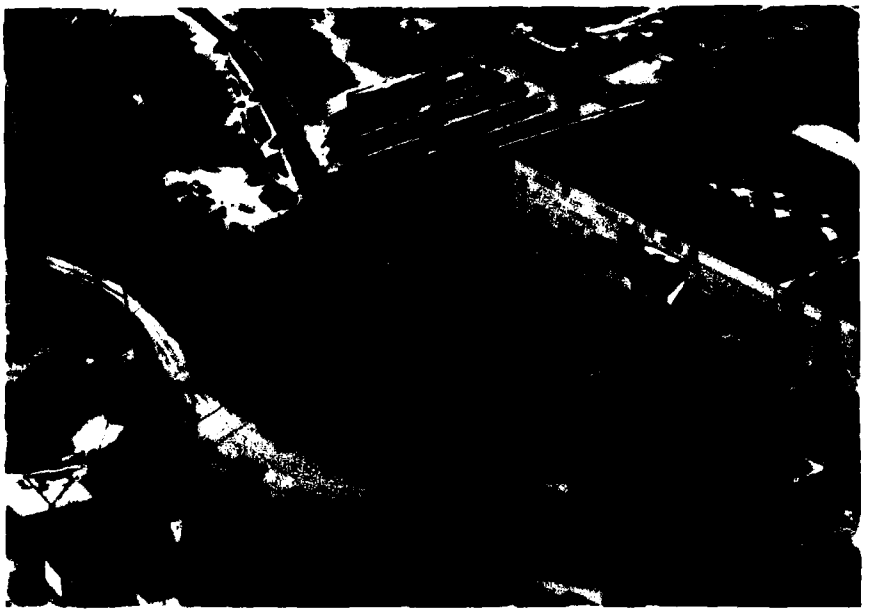
DETERIORATED SPILLWAY APRON

EDEN MILL DAM
31 DECEMBER 1980

31 DECEMBER 1980

PHOTO 9

DOWNSTREAM CHANNEL AT DAM SITE



20 JANUARY 1981

PHOTO 10

DOWNSTREAM CHANNEL 2000 FEET FROM DAM

EDEN MILL DAM

APPENDIX 3

Engineering Data

CHECK LIST

HYDROLOGIC AND HYDRAULIC DATA

ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Wooded, residential, and swampy areas

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 238.9 (43 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N/A

ELEVATION MAXIMUM DESIGN POOL: 245.8

ELEVATION TOP DAM: 239.9

PRINCIPAL SPILLWAY CREST: Uncontrolled Concrete Weir

a. Elevation 238.9

b. Type Ogee Shaped Concrete Weir

c. Width 2.0 feet

d. Length 136 feet

e. Location Spillover Center of dam

f. Number and Type of Gates None

AUXILIARY SPILLWAY CREST: Controlled Weir (Stoplogs)

a. Elevation 238.4 (primary), 239.2 (secondary)

b. Type Sharp Crested Weirs

c. Width 0.8 feet (primary), 0.5 feet (secondary)

d. Length 4 feet (primary), 8 feet (secondary)

e. Location Spillover Right end of dam

f. Number and Type of Gates Three sets of concrete stoplogs

OUTLET WORKS: (Auxiliary Spillway)

a. Type Removeable concrete stoplogs

b. Location Right end of dam

c. Entrance Invert 228.3

d. Exit Invert 228.3

e. Emergency Draindown Facilities: Remove stoplogs (not currently operable)

HYDOMETEOROLOGICAL GAGES: U.S.G.S. gaging station

a. Type Recording water level

b. Location 2.1 miles upstream

c. Records River stage and flow available from NJDEP

MAXIMUM NON-DAMAGING DISCHARGE:

(Lake Stage Equal to Top of Dam) 462 c.f.s.

APPENDIX 4

Hydraulic/Hydrologic Computations

HYDROLOGY:

HYDROLOGIC ANALYSIS:

THE RUNOFF HYDROGRAPH WILL BE DEVELOPED BY THE HEC-1-DAM COMPUTER PROGRAM USING SNYDERS SYNTHETIC UNIT HYDROGRAPH.

DRAINAGE AREA = 31.8 [SQ. MI]

INFILTRATION DATA:

INITIAL INFILTRATION = 1.5 in/Hr.

CONSTANT INFILTRATION = 0.15 in/Hr.

TIME OF CONCENTRATION:

["Introduction to hydrology" Pg 134 by Weissmann, Knopp, Lewis, Harbaugh]

1. $t_l = C_t (L L_{CA})^{0.3}$

$t_l = 2.0 (13.25 \times 6.63)^{0.3}$

$t_l = \underline{7.66 \text{ Hr}}$

t_l = Lag time [Hr]

C_t = Coefficient for slopes & storage

L = Length of stream channel from outlet to divide [MI]

L_{CA} = Length of main channel to watershed centroid [MI]

C_t = 2.0 (Supplied by Corps of Engineers)

$L = 70.000' = 13.25$ Mi

$L_{CA} = 35.000' = 6.63$ Mi

COMPUTER INPUT

LAG TIME = 7.7 Hr.

C_p = 0.62 (Supplied by Corps of Engineers)

PRECIPITATION :

[U.S. Dept. of Commerce - Rpt. 40 Weather bureau Pg. 57]

Probable Maximum Precipitation = 25.5 inches

for 6 hr. duration and 31.8 SQ MI. area

DURATION [Hr]	% PMP
6	90
12	98
24	107

LAKE STORAGE VOLUME:

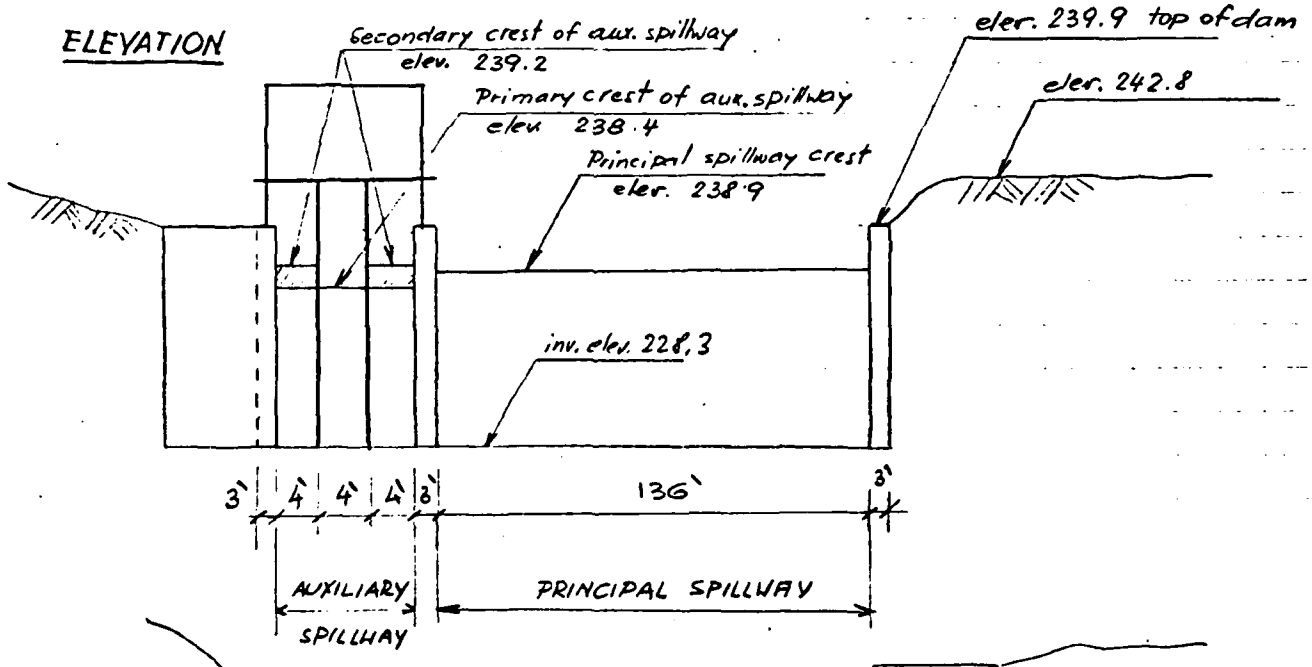
Water surface elev. [Ft]	Area [Acres]
229.0	0
239.0	12.9
250.0	59.7
260.0	163.00

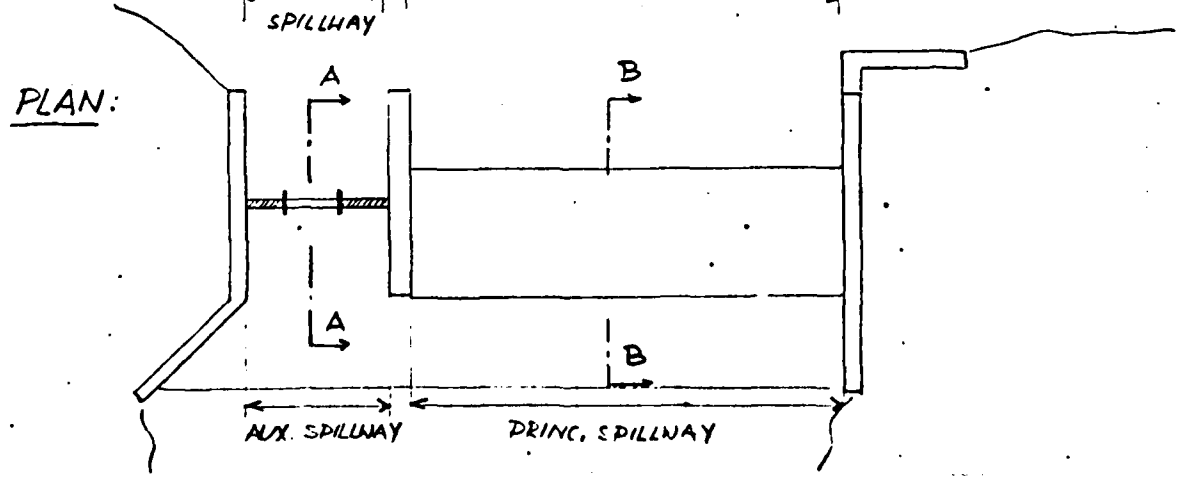
HEC-1-DAM COMPUTER PROGRAM WILL DEVELOP STORAGE CAPACITY FROM SURFACE AREAS & ELEVATIONS

INFORMATION TAKEN FROM U.S.G.S. QUADRANGLE Morristown, Mendham, N.J.

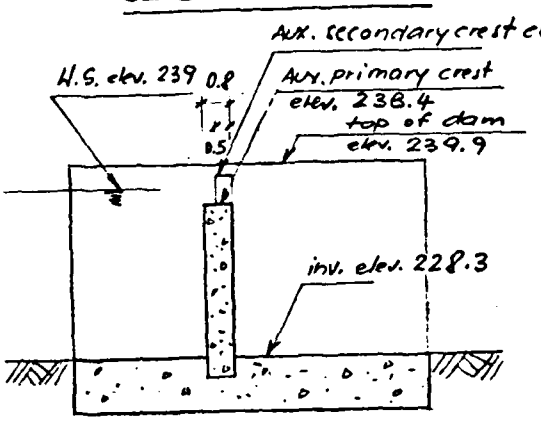
HYDRAULICS:

THE SPILLWAY AT THE EDEN MILL DAM CONSISTS OF A CONCRETE OGEE SHAPED FREE OVERFLOW PRINCIPAL SPILLWAY AND A CONCRETE STOPLOG CONTROLLED AUXILIARY SPILLWAY WITH PRIMARY AND SECONDARY CRESTS

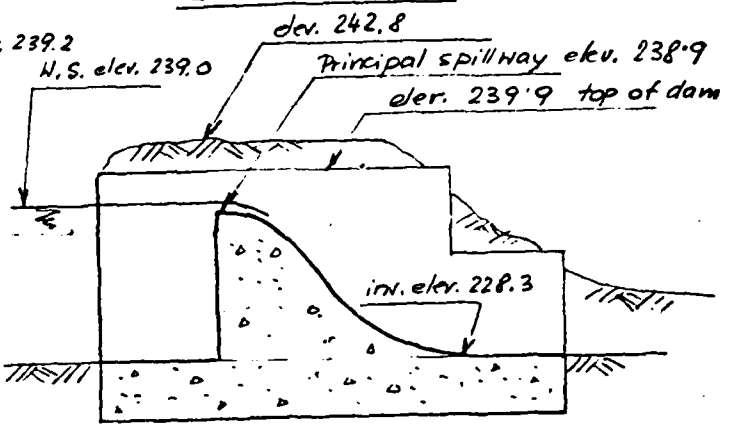




SECTION A-A



SECTION B-B



DISCHARGE CALCULATION:

[Handbook of hydraulics 5-40]

PRINCIPAL SPILLWAY: (OGEE CREST SPILLWAY)

ELEV.	238.9	[Ft]
Length	136	[Ft]

AUXILIARY SPILLWAY – (SHARP CRESTED WEIR)

primary crest –	ELEV.	238.4	[Ft]
	Length	4	[Ft]
	Width	0.8	[Ft]
secondary crest –	ELEV.	239.2	[Ft]
	Length	8	[Ft]
	Width	0.5	[Ft]

USING FORMULA:

$$Q = CLH^{3/2}$$

Q - discharge [cfs]
L - Length of spillway [Ft]
C - discharge coefficient
H - head on spillway [Ft]

STORCH ENGINEERS

Sheet 1 of 14

Project 1132-05 EDEN MILL DAM

Made By J.Ha Date 3-11-81

Chkd By JG Date 3/17/81

SPILLWAY STAGE DISCHARGE TABULATION

W.S. ELEV. [FT]	Principal spillway L = 136'			Auxiliary spillway						ΣQ
				Primary L = 4'			Secondary L = 8'			
	H [FT]	C	Q [cfs]	H [FT]	C	Q [cfs]	H [FT]	C	Q [cfs]	[cfs]
238.4	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
238.9	~~0~~	~~0~~	~~0~~	0.5	2.85	4.0	~~0~~	~~0~~	~~0~~	4.0
239.2	0.3	3.09	69.0	0.8	3.04	8.7	~~0~~	~~0~~	~~0~~	77.0
239.9	1.0	3.11	423.0	1.5	3.27	24.0	0.7	3.24	15.2	462.0
241.0	2.1	3.33	1378.0	2.6	3.31	55.5	1.8	3.32	64.2	1497.0
244.0	5.1	3.33	5216.0	5.6	3.32	176.0	4.8	3.32	279.0	5671.0
246.0	7.1	3.33	8568.0	7.6	3.32	278.0	6.8	3.32	471.0	9317.0
248.0	9.1	3.33	12432.0	9.6	3.32	395.0	8.8	3.32	693.0	13520.0

DAM BEGINS TO OVERTOP AT ELEV. 239.9

TOTAL LENGTH OF DAM = 178.0 FEET

For dam overtopping analysis, overall length of dam taken to be 298 feet to account for overflow adjacent to dam.

STORCH ENGINEERS

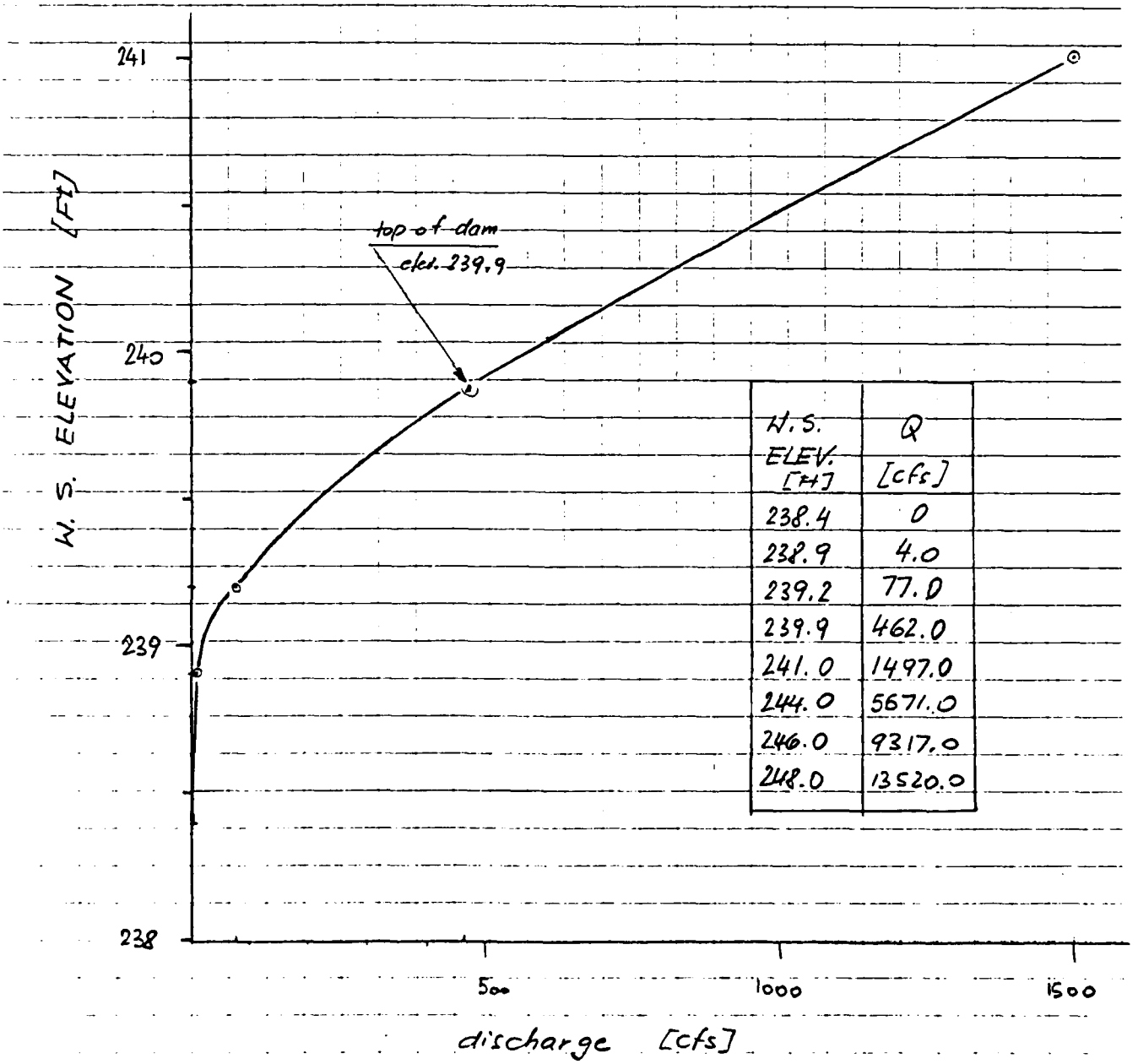
Project 1132-05 EDEN MILL DAM

Sheet 8 of 14

Made By JiHa Date 3-11-81

Chkd By JG Date 3/17/81

SPILLWAY STAGE DISCHARGE CURVE



W.S. ELEV. [Ft]	Q [cfs]
238.4	0
238.9	4.0
239.2	77.0
239.9	462.0
241.0	1497.0
244.0	5671.0
246.0	9317.0
248.0	13520.0

STORCH ENGINEERS

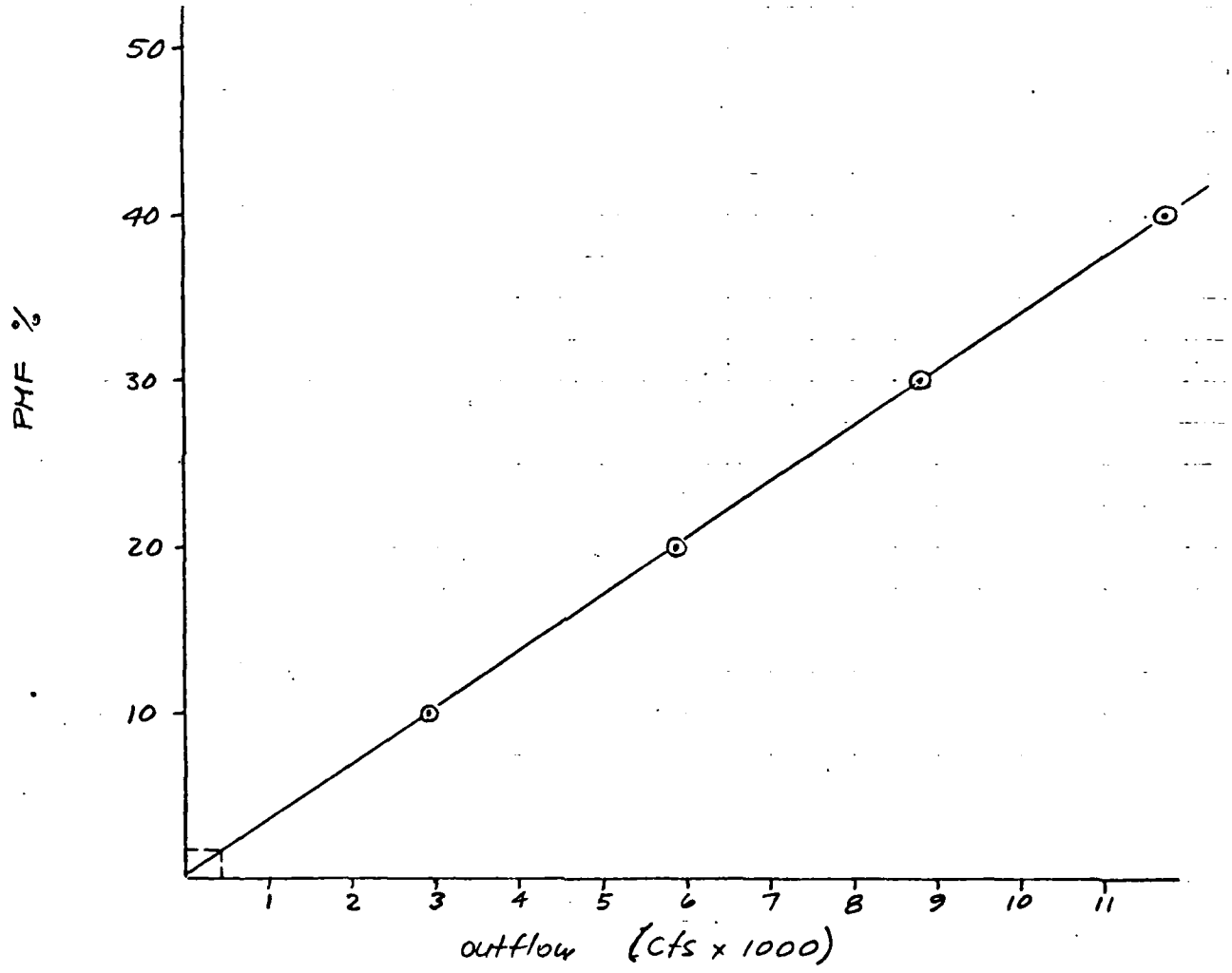
Project 113-05 EDEN MILL DAM

Sheet 9 of 14

Made By JHG Date 3-11-81

Chkd By JG Date 3/17/81

OVERTOPPING POTENTIAL



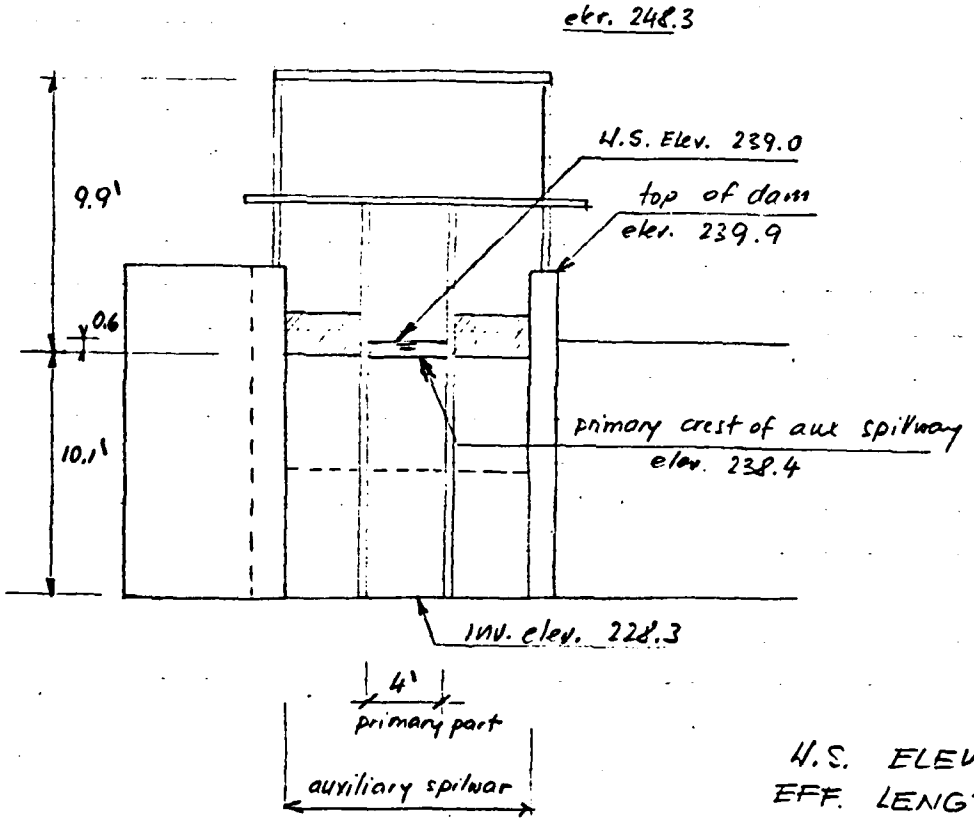
OVERTOPPING OF DAM OCCURS AT ELEV. 239.9 FEET

WITH A DISCHARGE Q = .462 cfs

DAM CAN PASS APPROX. 2% PMF

DRAWDOWN

DRAWDOWN CALCULATION PERFORMED ASSUMING THE REMOVAL OF CONCRETE STOPLOGS FROM CENTER SECTION OF AUX. SPILLWAY.



W.S. ELEV. = 239.0 [FT]
EFF. LENGTH = 4.0 [FT]

$$Q = CLH^{\frac{3}{2}}$$

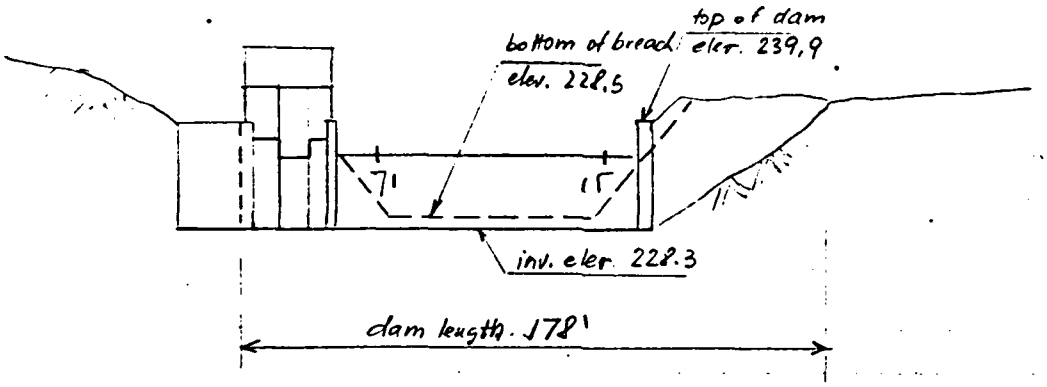
$$Q = 2.85 \times 4.0 \times \left(\frac{10.1}{2}\right)^{1.5} = \underline{129.4 \text{ cfs}}$$

TIME OF DRAWDOWN

$$Td = \frac{\text{Storage [Ac-ft]}}{\text{Ave discharge} - \text{Inflow}} = \frac{43 \times 43{,}560}{129.4 - 80.0} \times \frac{1}{3600} = \underline{10.6 \text{ Hr.}}$$

Assume Inflow 80.0 [cfs]

BREACH ANALYSIS:



A BREACH HYDROGRAPH WILL BE COMPUTED BY THE HEC-1-DAM PROGRAM AND ROUTED THROUGH THREE DOWNSTREAM REACHES BY THE MODIFIED PULS METHOD

Bottom of breach	elev.	=	228.5 [FT]
Length of bottom of breach 178' x 0.4		=	71.0 [FT]
Side slope of breach		=	1:1
Time to develop breach max. size		=	2.0 [Hr.]
Water surface elev.		=	239.0 [FT]
W.S. ELEV. which will cause dam to fail		=	239.9 [FT]

STORCH ENGINEERS

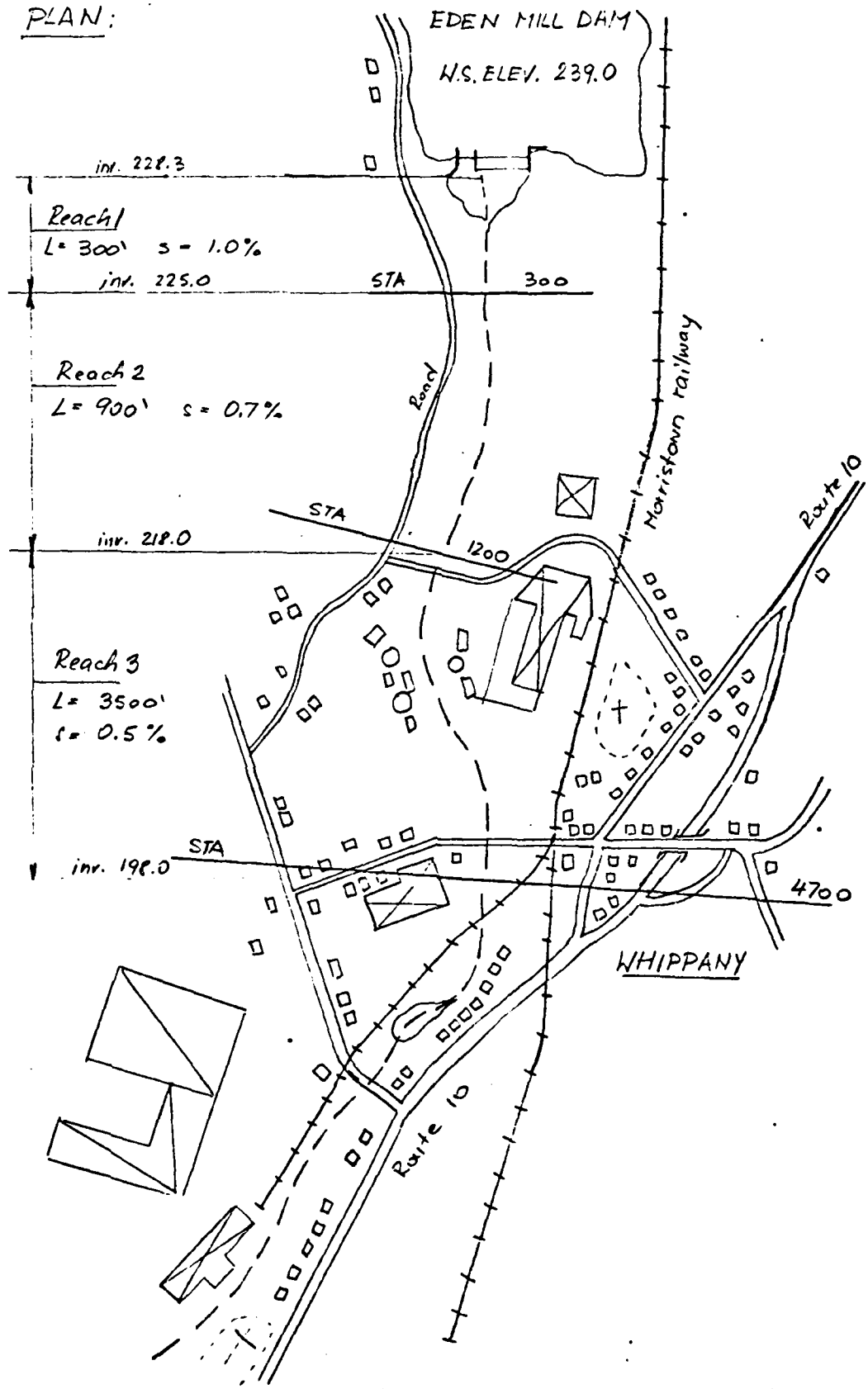
Project 1132-DE EDEN MILL DAM

Sheet 12 of 14

Made By JHS Date 3-11-81

Chkd By JG Date 3/17/81

PLAN:



STORCH ENGINEERS

Sheet 13 of 14

Project 1132-05 EDEN MILL DAM

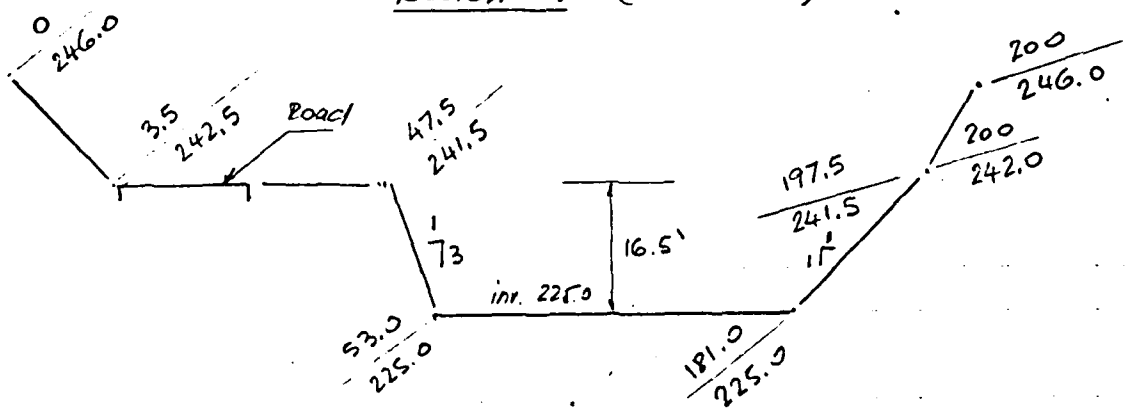
Made By JHa Date 3-11-81

Chkd By JG Date 3/17/81

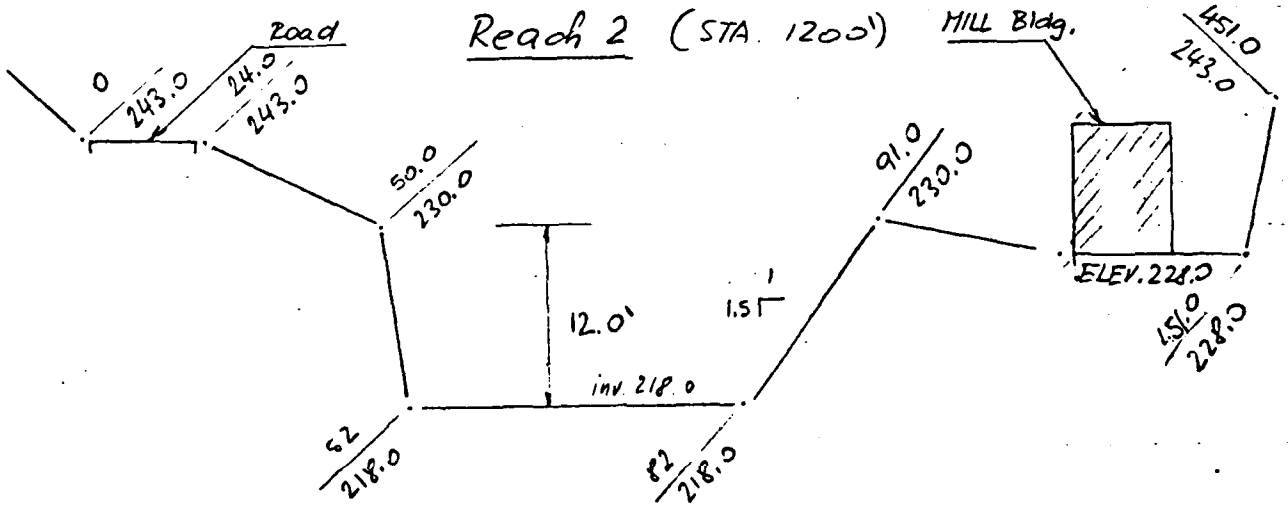
DOWNSTREAM CHANNEL

Typical cross sections

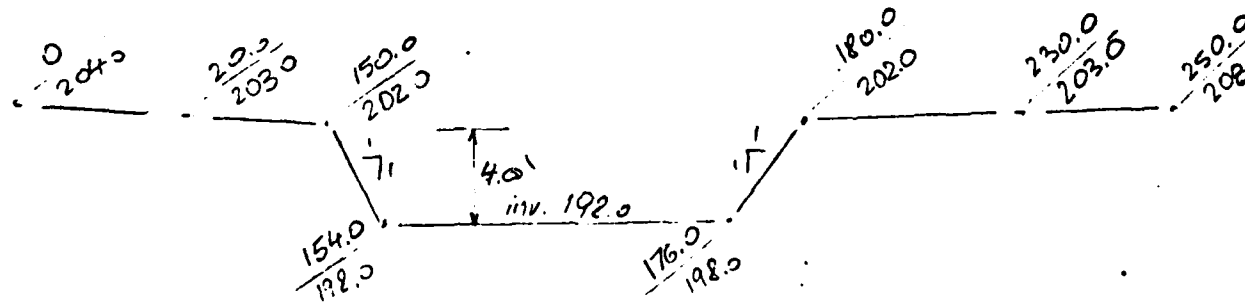
Reach 1 (STA 300')



Reach 2 (STA. 1200')



Reach 3 (STA. 4700')



BREACH RESULTS:

1. Peak outflow — With Breach = 14,627 cfs
   Without Breach = 14,645 cfs.

2. Max. channel stage

Reach 1 inv. elev. = 225.0 [Ft]
With Breach max. stage elev. = 232.3
Without Breach max stage elev. = 232.3

Reach 2 inv. elev. = 218.0 [Ft]
With Breach max. stage elev. = 232.2
Without Breach max stage elev. = 232.2

Reach 3 inv. elev. = 198.0 [Ft]
With Breach max. stage elev. = 209.8
Without Breach max stage elev = 209.8

HEC - 1 - DAM PRINTOUT

Overtopping Analysis

```
1A1                          NATIONAL DAM SAFETY PROGRAM
A2                           EDEN MILL DAM, NEW JERSEY
A3                           MULTI RATIO ROUTING
B     100       1        0                                                  4
B1      5
J       1       5        1
J1    0.5     0.4      0.3      0.2      0.1
K       0    LAKE                                          1
K1                           INFLOW HYDROGRAPH TO EDEN MILL DAM
M       1       1     31.8                31.8                            1
P             25.5       90       98      107
T                                                      1.5     0.15
W     7.7     .62
X    -1.0   -0.05      2.0
K       1     DAM                                      1       1
K1                           ROUTE DISCHARGE THROUGH DAM
Y                                        1       1
Y1      1                                                  235.0      -1
Y4  238.4   238.9    239.2    239.9    241.0    244.0    246.0   248.0
Y5      0     4.0     77.7    462.2   1497.7   5671.2   9316.9 13520.4
$A      6   12.66    57.67   163.6
$E  229.0   239.0    250.0    260.0
$$  238.4
$D  239.9    2.62      1.5      150
K       1       1                                          1
K1                           CHANNEL REACH ROUTING 1
Y                                        1       1
Y1      1
Y6   0.06   0.035     0.06    225.0    246.0      300    0.01
Y7      6   246.8      3.5    242.5     47.5    241.5      53      225      181      225
Y7  197.5   241.0      200      242      200      246
K       1       2                                          1
K1                           CHANNEL REACH ROUTING 2
Y                                        1       1
Y1      1
Y6   0.06    0.03     0.06    218.0    243.0      900   0.007
Y7      0     243       24      243       50      230      52      218       82      218
Y7     91     230      451      228      451      230
K       1       2                                          1
K1                           CHANNEL REACH ROUTING 3
Y                                        1       1
Y1      1
Y6   0.06    0.03     0.06    198.0    208.0     3500   0.005
Y7      0     204       20      203      150      202     154      198      176      198
Y7    180     262       25      203      250      208
K      99
```

NATIONAL DAM SAFETY PROGRAM
EDEN MILL DAM, NEW JERSEY
MULTI RATIO ROUTING

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
100	1	0	0	0	0	0	0	4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 5 LRTIO= 1

RTIOS=	.50	.40	.30	.20	.10

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH TO EDEN MILL DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LAKE	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	31.80	0.00	31.80	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	25.50	90.00	98.00	107.00	0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .837

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.50	.15	0.00	0.00

UNIT HYDROGRAPH DATA

TP=	7.70	CP=	.62	NTA=	0

RECESSION DATA

STRTQ=	1.00	QRCSN=	.95	RTIOR=	2.00

UNIT HYDROGRAPH 43 END-OF-PERIOD ORDINATES, LAG= 7.71 HOURS, CP= .62 VOL= 1.00

73.	271.	544.	853.	1170.	1436.	1609.	1681.	1623.	1456.
1267.	1103.	960.	836.	728.	634.	552.	481.	418.	364.
317.	276.	240.	209.	182.	159.	138.	120.	105.	91.
79.	69.	60.	52.	46.	40.	35.	30.	26.	23.
20.	17.	15.							

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	22.84	19.02	3.81	400714.
										(580.)	(483.)	(97.)	(11346.96)

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE DISCHARGE THROUGH DAM

ISTAO	ICOMP	IECON	ITARE	JPLT	JPRT	INAME	ISTADE	IAUTO
DAM	1	0	0	0	1	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTPL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-239.	-1

STAGE	238.40	238.90	239.20	239.90	241.00	244.00	246.00	248.00
FLOW	0.00	4.00	77.70	462.20	1497.70	5671.20	9316.90	13520.40
SURFACE AREA=	0.	13.	60.	163.				
CAPACITY=	0.	43.	410.	1481.				
ELEVATION=	229.	239.	250.	260.				

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
238.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
239.9	2.6	1.5	150.

OPERATION	STATION	AREA	PLAN	RATIO 1 .50	RATIO 2 .40	RATIO 3 .30	RATIO 4 .20	RATIO 5 .10
				RATIOS APPLIED TO FLOWS				
HYDROGRAPH AT	LAKE	31.80	1	14649.	11719.	8789.	5859.	2930.
		(82.36)		(414.80)(	331.84)(	248.88)(	165.92)(	82.96)(
ROUTED TO	DAM	31.80	1	14645.	11725.	8787.	5860.	2930.
		(82.36)		(414.70)(	332.01)(	248.83)(	165.94)(	82.97)(
ROUTED TO	1	31.80	1	14647.	11726.	8791.	5865.	2928.
		(82.36)		(414.77)(	332.03)(	248.93)(	166.08)(	82.92)(
ROUTED TO	2	31.80	1	14633.	11694.	8804.	5859.	2924.
		(82.36)		(414.35)(	331.13)(	249.29)(	165.90)(	82.79)(
ROUTED TO	3	31.80	1	14641.	11706.	8780.	5850.	2928.
		(82.36)		(414.57)(	331.49)(	248.63)(	165.64)(	82.90)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	239.00	238.40	239.90
	STORAGE	43.	36.	56.
	OUTFLOW	29.	0.	462.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	245.81	5.91	208.	14645.	38.00	23.00	0.00
.40	244.90	5.00	175.	11725.	35.00	23.00	0.00
.30	243.94	4.04	145.	8787.	31.00	23.00	0.00
.20	242.76	2.86	113.	5860.	27.00	23.00	0.00
.10	241.47	1.57	84.	2930.	21.00	23.00	0.00

PLAN 1 STATION 1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	14647.	232.3	23.00
.40	11726.	231.4	23.00
.30	8791.	230.4	23.00
.20	5865.	229.2	23.00
.10	2928.	227.7	23.00

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	14633.	232.2	23.00
.40	11694.	231.4	23.00
.30	8804.	230.4	23.00
.20	5859.	228.8	23.00
.10	2924.	225.1	23.00

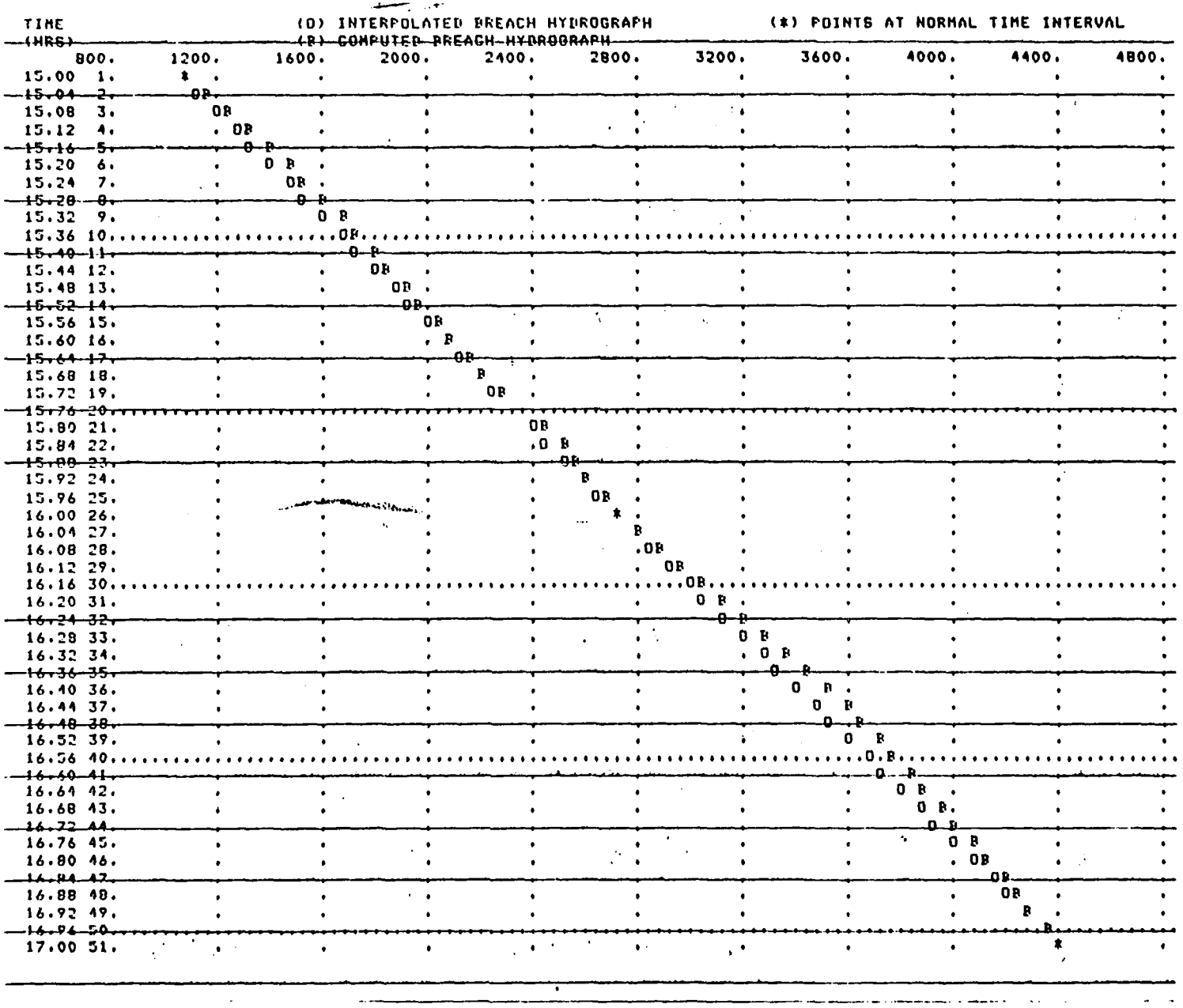
PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	14641.	209.8	23.00
.40	11706.	208.7	23.00
.30	8780.	207.5	23.00
.20	5850.	206.2	23.00
.10	2928.	204.5	23.00

HEC - 1 - DAM PRINTOUT

Breach Analysis

```
1A1                          NATIONAL DAM SAFETY PROGRAM
 A2                          EDEN MILL DAM, NEW JERSEY
 A3                          MULTI RATIO ROUTING
 B    100       1        0                                                  4
 B1     5
 J      1       5        1
 J1   0.5     0.4      0.3      0.2      0.1
 K      0    LAKE                                          1
 K1                        INFLOW HYDROGRAPH TO EDEN MILL DAM
 M      1       1    31.8.               31.8                              1
 P             25.5      90       98      107
 T                                                    1.5     0.15
 W    7.7     .62
 X   -1.0   -0.05      2.0
 K      1     DAM                          1         1
 K1                        ROUTE DISCHARGE THROUGH DAM
 Y                                  1         1
 Y1     1                                              239.0      -1
 Y4 238.4   238.9    239.2    239.9    241.0    244.0    246.0    248.0
 Y5     0     4.0     77.7    462.2   1497.7   5671.2   9316.9 13520.4
 $A     0   12.85    57.67    163.0
 $E 229.0   239.0    250.0    260.0
 $$ 238.4
 $B 239.9    2.63      1.5      150
 $B  71.0       1    228.5      2.0    239.0    239.9
 K      1       1                                          1
 K1                        CHANNEL REACH ROUTING 1
 Y                                  1         1
 Y1     1
 Y6  0.06   0.035     0.06    225.0    246.0      300     0.01
 Y7     0   246.0      3.5    242.5     47.5    241.5       53      225      181      225
 Y7 197.5   241.0      200      242      200      246
 K      1       2                                          1
 K1                        CHANNEL REACH ROUTING 2
 Y                                  1         1
 Y1     1
 Y6  0.06    0.03     0.06    218.0    243.0      900    0.007
 Y7     0     243       24      243       50      230       52      218       82      218
 Y7    91     230      451      220      451      230
 K      1       3                                          1
 K1                        CHANNEL REACH ROUTING 3
 Y                                  1         1
 Y1     1
 Y6  0.06    0.03     0.06    198.0    208.0     3500    0.005
 Y7     6     264       26      203      150      202      154      198      174      198
 Y7   180     202      230      203      250      208
 K     99
```


TIME
(HRS)
(O) INTERPOLATED BREACH HYDROGRAPH
(B) COMPUTED BREACH HYDROGRAPH
(*) POINTS AT NORMAL TIME INTERVAL
800.
1200.
1600.
2000.
2400.
2800.
3200.
3600.
4000.
4400.
4800.
15.00 1.
15.04 2.
15.08 3.
15.12 4.
15.16 5.
15.20 6.
15.24 7.
15.28 8.
15.32 9.
15.36 10.
15.40 11.
15.44 12.
15.48 13.
15.52 14.
15.56 15.
15.60 16.
15.64 17.
15.68 18.
15.72 19.
15.76 20.
15.80 21.
15.84 22.
15.88 23.
15.92 24.
15.96 25.
16.00 26.
16.04 27.
16.08 28.
16.12 29.
16.16 30.
16.20 31.
16.24 32.
16.28 33.
16.32 34.
16.36 35.
16.40 36.
16.44 37.
16.48 38.
16.52 39.
16.56 40.
16.60 41.
16.64 42.
16.68 43.
16.72 44.
16.76 45.
16.80 46.
16.84 47.
16.88 48.
16.92 49.
16.96 50.
17.00 51.

OPERATION	STATION	AREA	PLAN	RATIO 1 .50	RATIO 2 .40	RATIO 3 .30	RATIO 4 .20	RATIO 5 .10
				RATIOS APPLIED TO FLOWS				
HYDROGRAPH AT	LAKE	31.80	1	14649.	11719.	8789.	5859.	2930.
		(82.36)		(414.80)(	331.84)(	248.88)(	165.92)(	82.96)(
ROUTED TO	DAM	31.80	1	14627.	11727.	8797.	5861.	2931.
		(82.36)		(414.19)(	332.06)(	249.00)(	165.95)(	82.99)(
ROUTED TO	1	31.80	1	14637.	11736.	8810.	5853.	2944.
		(82.36)		(414.47)(	332.33)(	249.48)(	165.74)(	83.36)(
ROUTED TO	2	31.80	1	14645.	11706.	8829.	5841.	2960.
		(82.36)		(414.69)(	331.47)(	250.02)(	165.39)(	83.83)(
ROUTED TO	3	31.80	1	14659.	11714.	8784.	5855.	2934.
		(82.36)		(415.09)(	331.71)(	248.75)(	165.79)(	83.08)(

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	239.00	238.40	239.90
STORAGE	43.	36.	56.
OUTFLOW	29.	0.	462.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	241.47	1.57	84.	14627.	9.68	23.00	15.00
.40	240.57	.67	67.	11727.	6.52	23.00	15.00
.30	240.04	.14	58.	8793.	1.36	23.00	15.00
.20	240.21	.31	61.	5861.	1.48	23.00	16.00
.10	240.15	.25	59.	2931.	1.40	23.00	17.00

PLAN 1 STATION 1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	14637.	232.3	23.00
.40	11736.	231.4	23.00
.30	8810.	230.4	23.00
.20	5853.	229.2	23.00
.10	2944.	227.7	23.00

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	14645.	232.2	23.00
.40	11706.	231.4	23.00
.30	8829.	230.4	23.00
.20	5841.	228.8	23.00
.10	2960.	225.1	23.00

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	14659.	209.8	23.00
.40	11714.	208.7	23.00
.30	8784.	207.5	23.00
.20	5855.	206.2	23.00
.10	2934.	204.5	23.00

APPENDIX 5

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